

Student voices in formative assessment feedback

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Student voices in formative assessment feedback

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Editorial: Student voices in formative assessment feedback

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KEYWORDS

assessment, feedback, formative assessment, student's perceptions, effective feedback practices

Editorial on the Research Topic

Student voices in formative assessment feedback

The Research Topic, “*Students’ Voices in Formative Assessment Feedback*”, explores students’ experiences and emotions regarding formative assessment feedback. The nine articles in this Research Topic contribute valuable new insights. This editorial provides an overview of the studies included and summarizes their contributions.

Article overview

[Andersson et al.](#) investigated how students engaged with assessment feedback in an intervention study involving Swedish 10th-grade students. Their findings showed a positive association between the implementation of formative assessment through ongoing feedback cycles and students’ autonomous motivation.

[Brooks et al.](#) examined the effects of a teacher professional learning intervention that used a student-centered feedback model in Australian primary schools on students’ perceptions of the helpfulness of feedback. Their findings highlight the value of combining strategies that help students self-regulate their learning using feedback.

[Brandmo and Gamlem](#) conducted a systematic review examining student perceptions of feedback and its impact. The authors found that feedback quality had the greatest impact on student learning outcomes. Their findings point to the value of providing students with tailored, informative and action-oriented feedback.

[Lipnevich et al.](#) examined the choices made by higher education students in the United States when rejecting feedback provided to them. Reasons for rejecting feedback were mainly related to the “message,” which was perceived as unclear or overwhelming.

[Moltudal et al.](#) studied writing in the 8th-grade in Norway, investigating students’ perceived usefulness of AI-feedback compared to peer feedback. Their findings highlight the role of trust in digital devices and how social class hierarchy affects students’ perceived competence in providing peer feedback.

[Rienits](#) investigated how medical students assess their peers during formative clinical assessments. The findings indicate that students report learning as much or more from being the assessor as they do from being assessed. However, the author questioned whether this experience leads to deeper learning or merely deepens knowledge about the test and the assessment process.

The systematic review by Solis Trujillo et al. examined graduate students' perceptions of formative feedback. The findings highlight the crucial role of formative feedback in potentially strengthening both learning and academic engagement.

Westphal et al. investigated the perceptions of first-year university students in Germany on oral assessment and their view of oral grading as a reliable measure of their competence. Their findings suggest that a lack of transparency reduces students' perceptions of oral grading as being valid.

To et al. conducted an action research project involving three teachers in six classes of 10th-grade students in Singapore. Their findings indicate that feedback tools stimulate students to verbalize their understanding of the feedback, thereby enhancing their autonomy.

Main contributions

Feedback design

Several common findings can be identified from the nine studies, highlighting students' views on constructive assessment feedback. Students want feedback that is clear, understandable, and action-oriented, provided in dialogue with a teacher or a peer they trust personally and academically (Brandmo and Gamlem; Brooks et al.; Solis Trujillo et al.; To et al.). Moreover, the use of multiple strategies to engage students, along with fostering a deep understanding of success criteria, appears to substantially impact students' perceptions of feedback helpfulness (Andersson et al.; Brooks et al.; Lipnevich et al.; To et al.). Anchoring feedback in familiar success criteria may also influence students' perceptions of assessment validity (Westphal et al.).

Feedback engagement

When teachers encourage students to actively engage with formative feedback, it can increase students' autonomy and promote deeper learning (Andersson et al.). Being able to learn autonomously is particularly crucial for students who are approaching graduation and entering the workforce (Solis Trujillo et al.).

Empowering feedback targets cognitive and metacognitive processes, offering feedforward to enhance students' self-regulation skills (Solis Trujillo et al.). This aligns with Brooks et al., who advocated for meta-conversations with students about the purpose of feedback, encouraging them to view themselves as agentic learners. Furthermore, several studies have linked student engagement with feedback to teacher sensitivity to students' psychological needs (Brandmo and Gamlem; Lipnevich et al.; To et al.).

Peer feedback

Findings from the studies in this Research Topic indicate that peer assessment can enhance students' familiarity with assessment conditions and improve their feedback strategies (Moltudal et

al.; Rienits). However, implementing peer assessment can be challenging, as students may feel uncomfortable or lack trust in their peers' competence or intentions (Lipnevich et al.; Rienits). Moreover, Brooks et al. found that peer feedback was sometimes preferred by students over teacher feedback. They emphasized the importance of clearly defining success criteria and ensuring that students understand what constitutes success before engaging in peer assessment. Both Brooks et al. and Solis Trujillo et al. identified links between peer assessment and the development of self-assessment skills.

Technology provided feedback

Furthermore, the published articles offer new insights into the application of AI in providing assessment feedback. To a certain degree, AI can offer timely, personalized feedback (Solis Trujillo et al.). In addition, Moltudal et al. demonstrated that AI-generated feedback facilitates dialogic feedback interactions to a greater extent than traditional peer feedback. However, personalized teacher feedback is not replaceable (Brandmo and Gamlem; Moltudal et al.), as personal relationships and shared understandings between participants in the feedback process are essential (Brandmo and Gamlem; Lipnevich et al.). AI does not possess the sensitivity or ability of teachers to interpret student needs within specific contexts. Nevertheless, Moltudal et al. found that students trusted computer software, differing from the findings of Lipnevich et al., who noted the importance of personal trust in feedback sources. Similarly, Solis Trujillo et al. reported that technology-based feedback supports self-assessment and fosters autonomous learning.

Further research

Based on these study findings, we identified three areas needing further research: (1) the relationship between AI-assisted feedback and student emotions, (2) the long-term impacts of changes to formative classroom practices, and (3) improving the integration of formative feedback into assessments using various modes, including oral participation. Future work should extend the findings of this Research Topic, placing the student voice at the center to ensure that formative assessment research continues to be driven by the needs of learners.

Author contributions

PF: Writing – original draft. FV: Writing – review & editing. WR: Writing – review & editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The other side of the mark sheet: lessons learnt when medical students assess peers in formative clinical examinations

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This study aimed to investigate the experience of medical students assessing their cohort peers in formative clinical assessment. The exercise was designed to provide students with a formative experience prior to their summative assessment, and to determine what students could learn by being on the “other side of the mark sheet.” Students were grateful for the experience learning both from the assessment practice, and from the individual written feedback provided immediately afterwards. They also described how much they learnt from seeing the assessment from the assessor’s viewpoint, with many students commenting that they learnt more from being the “assessor” than from being the “student” in the process. Students were asked how they felt about being assessed by their peers, with some describing the experience as being more intimidating and stressful than when compared to assessment by clinicians. An interesting aspect of this study is that it also demonstrates some findings which suggest that the students’ current learning context appears to have an effect on their attitudes to their peers as assessors. It is possible the competitive cultural milieu of the teaching hospital environment may have a negative effect on medical student collegiality and peer support.

KEYWORDS

peer assessment, student, experience, formative, OSCE

Introduction

Peer assessors have been used by many medical training institutions to enable trainees to have a formative Objective Structured Clinical Examination (OSCE) experience at lower cost to the institution (1–4). Generally, when “peer” medical student assessors are used, they are in fact “near peer” and more advanced in their training compared to those they are assessing (2, 3). However, some recent studies have been undertaken using “same cohort” or “reciprocal” peers to ascertain the learning value in having these peers as assessors (4–6).

In addition to the opportunity to practice skills, a peer assessed formative OSCE can also provide students with individual feedback. Feedback in formative assessment has been shown to be a powerful aid to deep learning (7) and some excellent research has provided good advice re the process of giving this feedback (8), especially in relation to its timeliness, and individual descriptive text rather than just broad grades or marks. However, most of the studies conducted on the power of feedback in formative assessment have been done using

experienced clinicians or professionals to provide the feedback to the trainee (7, 9). More studies are needed on the efficacy of feedback provided by peers, especially reciprocal peers.

OSCEs are widely used in health profession training to assess developing competence in clinical performance (10, 11). However, individual performance-based assessment can be a stressful experience for the trainee and performance-based anxiety has been shown to impact trainee performance (12, 13). Many medical schools therefore provide students with a formative OSCE experience in advance of the summative assessment to help them prepare, and relieve some of their anxiety.

The style of the mark sheet also provides its own challenges. Studies have noted that compared with using checklists, junior assessors struggle with the concept of global rating in mark sheets, even when there are good descriptions of the mark criteria (14, 15). When using student peer assessors, inter-assessor reliability of results has been found to be poor compared with that of experienced assessors (2, 3, 16, 17). However as the purpose of the formative OSCE is usually to provide the students with an opportunity to become familiar with the process and physical context of OSCE, inter-assessor reliability may not necessarily be considered a major objective.

Being assessed by peers in a formative OSCE enables the student to have an OSCE practice experience, and receive feedback on their performance. This should be a useful learning exercise for the student. However, there has been comparatively little research around the student experience of cohort peer assessment. Does being the assessor enable the student to become more clearly acquainted with the standards of knowledge and skills expected of their level of training? Does providing feedback for their peers provide the student with insight relating to how their own performance compares with the expected standard? Therefore this study aimed to investigate the student experience of assessing, and being assessed by, their cohort peers in a formative OSCE.

Methods

This study aimed to investigate the research question through the student perspective. Students' opinions were sought regarding how useful they found the exercise for their learning, both as a student and as an assessor. Both qualitative and quantitative data were collected in an effort to gauge the extent, and the depth, of responses to the questions.

During the compulsory formative OSCEs over 3 years: 2017 – 2019, medical students at the end of second (P1), third (P2), and fourth (P3) years, were assessed by their cohort peers, and had the opportunity to assess their peers. Students worked in groups of eight. During the first round, four of the students rotated around a circuit completing four different stations, while the other four students took the role of the assessor on one station each. In the second round, the students swapped roles and repeated the process with four new stations. Trained volunteers from the community played the roles of simulated patients. Location, clinical set up, OSCE timing and “bells,” and all station assessment materials, including the mark criteria and mark sheets, were in exactly the same format and

standard as the summative OSCE for their respective Phase. Our OSCE mark sheets use global rating scales for each domain, with descriptive mark criteria of expected standards. The mark sheets also allow assessors to provide written feedback to the candidate, and our peer assessors were encouraged to complete this section as well when marking, so that all students received individual written feedback on their performance. Supervising clinical tutors also provided verbal feedback afterwards to each group of 8 students.

Immediately following the completion of the OSCE, each student collected their own mark sheets and viewed their written feedback. As this was a formative assessment, the school did not retain or record the grades or feedback. The students were then invited to complete an anonymous survey regarding the experience. Students had received prior information regarding the survey and were aware that their participation in the survey was voluntary.

The survey questions, specifically designed for this study, were based on a pilot study conducted in 2016 with P1 medical students. The results of the pilot are not included in this study, but it helped to refine the questions for this subsequent survey. Because the survey was conducted over 3 years, students who were first surveyed at the end of P1 (in 2017) were surveyed again at the end of P2 (in 2018), and then again at the end of P3 (in 2019). Other cohorts were similarly surveyed over sequential years. This allowed some longitudinal tracking of cohort responses as they progressed through the course. Individual student responses however, could not be tracked longitudinally due to the anonymous nature of the survey.

The context of the student training differs over the three Phases of our course P1, P2, and P3. P1 students spend most of their time studying the medical sciences, with the clinical component learnt during Clinical Skills on campus, and brief placements in local community practices. P2 students spend the Phase based in teaching hospitals rotating through standard blocks in Medicine, Surgery, Mental Health, etc. P3 students by contrast, spend the whole phase based in community practices, with added training in the Emergency Departments of local hospitals. Most P3 students are based in regional and rural centers for the year. Including students from all Phases enabled a comparison of cohorts across different levels of training and between different training contexts.

The survey aimed to ascertain what students could learn when they assess their peers in a formative OSCE. Survey questions were grouped under 4 topics to investigate their perception of the learning value of the exercise from:

- (A) Participating in a formative OSCE both as a “student” (3), and as an assessor (2)
- (B) Completing the mark sheet as an assessor (4)
- (C) Being an assessor of their peers (3)
- (D) Being assessed by their peers (6)

Students were asked to indicate their agreement with statements regarding these topics on a five-point Likert scale. Following each set of topic questions, students were asked to share “Any other comments?” in a free text box. The Human Research Ethics Committee of the university approved these studies - Ref Nos: 2017/030, 2018/010, & 2019/011.

TABLE 1 Student survey responses on their experience of the formative OSCE.

Table 1	SD	D	N	A	SA
1A: On having this formative/ practice OSCE					
All OSCE practice is helpful to prepare for the summative OSCE	0	0	1	26	73
It was useful to practice with the bells and the timing	0	0	0	20	80
It helped to see the kind of scenarios and tasks for this phase	0	0	1	20	79
It helped to understand the standard expected for this phase	0	2	3	25	70
It helped to understand the marking process	0	0	4	24	72
1B: On being an OSCE assessor					
Global Judgments very difficult	3	23	25	41	8
I felt I needed more specific marking guidelines	5	23	25	26	6
It is difficult knowing how to split the borderline (pass/fail) grades	1	14	20	56	9
I learnt more being an “assessor” than being the “student”	2	13	35	37	13
1C: On assessing my peers					
It is difficult to be critical because we are assessing our peers	5	31	22	35	7
It is hard to mark your peers objectively	5	38	21	35	4
I do not feel competent to assess my peers	6	45	31	15	3
1D: On being assessed by my peers					
I didn't mind being assessed by my peers at all	1	4	10	49	36
It is less stressful being assessed by my peers (than by clinicians)	3	18	29	32	18
It was intimidating being assessed by my peers	11	46	24	17	2
It felt less objective than being assessed by a clinician or a stranger	3	28	30	31	8
I do not feel my peers are competent to assess me	17	54	19	5	2
This exercise was not helpful because assessors were not real clinicians	25	49	16	8	2

The five-point Likert scale was graded as follows: SD, Strongly Disagree; D, Disagree; N, Neutral; A, Agree; SA, Strongly Agree.

Results

There was a good response rate to the voluntary survey with 684 responses / 702 participants (97%) in total from P1, P2, and P3 students, during the 2017, 2018 and 2019 formative OSCEs.

Quantitative Results: The combined results for all three cohorts in all 3 years of the study are summarized in [Table 1](#) and expressed as a rounded percentage of all those who answered that question.

- (A) On participating in the formative OSCE. Student agreement with the statements in this section was over 95%. They agreed it was helpful to practice with the OSCE ‘bell’s, timing, and kinds of scenarios and tasks that they were likely to encounter in the summative as students. They also agreed (95%) that being an assessor helped them to understand the standard expected and how the marking process worked.
- (B) On being an OSCE assessor. The next four statements ([Table 1B](#)) related to experiencing the OSCE effectively from “the other side of the mark sheet” and the challenges of OSCE assessment. Between 50 and 65% of students agreed with statements that using global judgment and deciding the pass/fail borderline grades were difficult. When asked whether they learnt more from being the “assessor” than the “student” in the exercise, 50% of students agreed while 26% disagreed.

- (C) On assessing my peers. The survey then covered the aspects of what it felt like to assess your peers ([Table 1C](#)). In almost all cases, the student assessors knew the student candidates they were assessing as friends and colleagues. This added a dimension to the process which many found difficult (42%).
- (D) On being assessed by my peers. The final six statements ([Table 1D](#)) asked the students how they felt about being assessed by their peers. The majority of students did not mind being assessed by their peers in this formative setting (85% agreed). However, approximately 20% of students reported feeling that it was intimidating to be assessed by their peers.

Qualitative Results: Of the 684 responses to the survey, approximately 390 responses (57%) contained added comments in the free text boxes following the sets of quantitative questions. Selected examples representing frequently occurring themes in the comments are presented below under the relevant survey topic headings.

- (A) On participating in the formative OSCE. There were many positive comments expressing how helpful students found the exercise and the feedback opportunities.

"All up I enjoyed the formative- it will help me prepare for the summative and I now know what I need to work on" (P1)

"I appreciated the opportunity for feedback" (P3)

"Having a clinician around to give us advice when we are assessing was exceptionally helpful" (P3)

(B) On being an OSCE assessor. There were many comments concerning having the opportunity, as "assessors," to see the marking criteria and mark sheets as they applied to set scenarios and tasks.

"Great to look at the marking criteria and get a feel about what assessors are looking for" (P3)

"To understand how the OSCE "worked" to assess a student's capabilities." (P1)

"Marking expectations were clear but the global judgment was most difficult" (P2)

(C) On assessing my peers. Student comments reflected some of the issues they experienced when assessing peers.

"Difficult removing preconceptions about your peers" (P3)

"I felt biased toward my friends over other colleagues and wanted to give them higher marks" (P1).

"It is hard to not prompt friends/peers when they are stuck" (P1)

"It's hard giving negative feedback when they are your friends" (P1)

There were also a number of comments about the experience of being able to watch a number of peers complete a task in their unique styles.

"Great to see other student's style of history and examination" (P1).

(D) On being assessed by my peers. Most of the comments in this section came from the 20% of students who found assessment by their peers to be stressful or intimidating.

"Sometimes it can be disheartening if you make errors in front of your peers but I trust their judgement" (P1)

"OK with some students but others are judgmental, unprofessional" (P2)

Differences between the Phases in the peer- assessed OSCE.

For the majority of questions, the student responses were very similar when compared across the three phases of training. There were however, a few questions where some differences were noted. These differences were between the phases (or stages of training) and were consistently noted across the 3 years of the study. The differences are displayed in the graphs in [Figures 1–3](#). When asked how objective it felt being assessed by peers ([Table 1D](#)), there was a spread of responses which differed from Phase to Phase as illustrated in [Figure 1](#). Phase 2 students differed to Phases 1 and 3.

The difference between the Phase 2 students and the other two phases was noted in another question relating to whether the students felt the formative OSCE was helpful despite being peer,

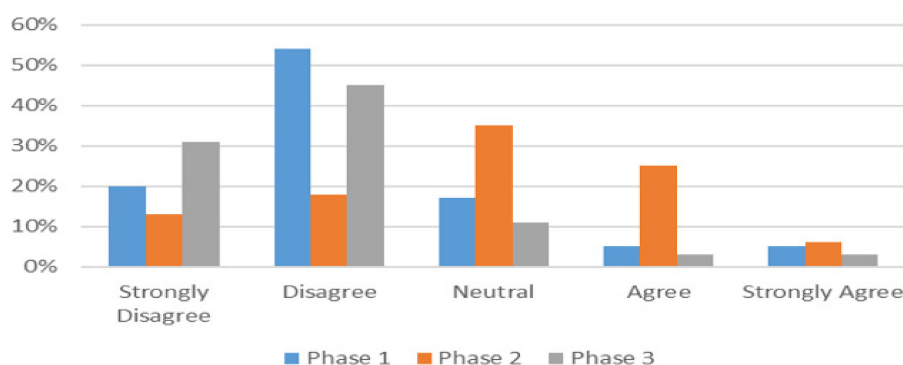


FIGURE 1

It felt less objective than being assessed by a clinician or a stranger.

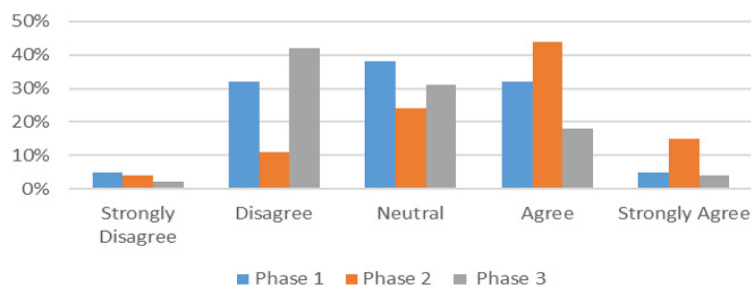


FIGURE 2

This was not helpful because the assessors weren't real clinicians.

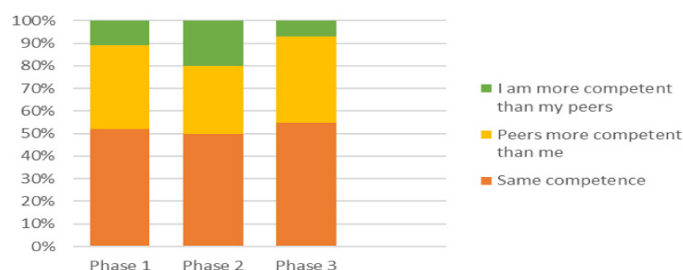


FIGURE 3

Differences in perceived competence to assess peers between the phases.

rather than clinician assessed (Table 1D). Figure 2 shows Phase 2 mostly agreed that it was not helpful, while the other Phases mostly disagreed. The comments relating to this issue were entirely from Phase 2 students such as the following 2 examples.

"It would be good to have clinicians so a more experienced person is marking rather than peers"

"Clinician feedback would be valuable as students don't know enough to assess"

Student perceptions regarding their competence to assess peers.

Finally, in one section of the survey, students were asked to indicate their level of agreement with the statement: "I do not feel competent to assess my peers" (Table 1C), and in the following section, they were asked to indicate their level of agreement with the statement: "I do not feel my peers are competent to assess me" (Table 1D). These two statements were tracked and compared individually for each student across 684 survey responses. Just over half the students indicated the same level of agreement to both statements (Figure 3).

Of those that differed, the majority felt that other students were more competent to assess them, than they were to assess others (range 30.5% - 38.5%). A small proportion however, felt they were more competent to assess their peers, than their peers were to assess them. Again, it was the Phase 2 students who differed from the other cohorts as depicted in Figure 3 (10% P1, 20% P2, and 7% P3). Using Chi Square with a Fisher's Exact test, combining Phases 1 and 3, and then compared to Phase 2 with all three groups, and including the percentage of students who reported feeling the same

level of competence as their peers, less competent than their peers, and more competent than their peers, $P = 0.0465$, confirming the difference in the Phase 2 response is statistically significant.

Almost all students who registered different "levels of competence to assess" between these two statements, only moved one "grade" of agreement one way or the other. However, in one section only, (the Phase 2 students who felt themselves more competent than their peers to assess others), 27% recorded a difference of two or more grades. These students believed that they were much more competent to assess their peers, than their peers were to assess them. This pattern was consistent across all the cohorts of students surveyed as they moved through from Phase 1, to Phase 2 and finally to the end of Phase 3.

Discussion

As with most formative assessments, peer- assessed OSCEs are primarily intended as assessment for learning rather than an assessment of learning (18). Using the students to assess their peers was therefore not just a cost cutting exercise, but designed to enhance student learning. Being able to sit a practice OSCE in the format and at the standard of the summative assessment was in itself a learning opportunity. This research however was designed to investigate the student experience of assessing, and being assessed by, their cohort peers in a formative OSCE.

The survey indicated that our students felt they had learnt as much or more being the assessor than from being the student participant in the formative OSCE. Other studies have also noted that even "near peer" student assessors said they learnt much from being assessors of their junior colleagues in developing their own

clinical skills (3). Some students noted it was very helpful to watch how different students tackle a station, and observe the different styles of communication. Other research has also noted that peer assessors found they had learnt a lot about communication skills when observing and assessing peers (4). However just seeing the written mark criteria and expected standards is in itself relatively superficial learning in the assessment of clinical competence (19).

Seeing the station from the assessor perspective and having to provide their peers with feedback can provide some insight into their own OSCE process and performance techniques. Others have shown that this kind of learning may change the way students both prepare for their summative assessments, and structure their performance (20, 21). It may result in improved OSCE marks, but again we must ask whether this truly represents deeper learning for future clinical practice, or just for assessment performance.

The survey results indicate that most students struggled with the difficulty of deciding global grades especially around the borderline mark. Clinician assessors also struggle being confident in this aspect of clinical assessment (22, 23), and it suggests that participation as an assessor in a formative OSCE can provide some insight into the essentially subjective process of performance-based assessment. Students also noted the difficulty marking friends objectively. The desire to help and encourage your friends rather than give “negative” feedback is similar to the problems clinician assessors experience when asked to assess their own student (24). The desire to help your colleague pass even if not at the standard expected, and the difficulty recognizing bias while struggling to be objective, are important self-reflective insights (25).

One of the unexpected findings from this study was the clear differences between the Phases in a small number of key areas. The student responses in terms of their perceived competence to assess relative to their peers, was clearly different in students in Phase 2 compared to the other phases. This same pattern was repeated in each of the 3 years that these studies were conducted so it was unlikely to be due to individual cohort variation. The major difference for students in Phase 2 is the training context that these students have been immersed in for the preceding year. In Phase 2 students have just completed a 12-month hospital placement rotating through various hospital disciplines. The teaching hospital is an intense and highly competitive atmosphere, and these junior medical students spend most of their placement time with junior doctors, who are themselves competing for more advanced specialist training positions.

As this survey was conducted at the end of the phase, it is possible that the “hidden curriculum” of deeply embedded cultural norms in the teaching hospital (26, 27), had an effect on the Phase 2 students’ self-perception of competence compared to their peers. Some of the responses seen in the Phase 2 students are at odds with the peer support, teamwork, collegiality, and compassion, which are professionalism skills we want our students to understand and develop (25). More recently, others in the field have shown that deeply embedded cultural norms, especially seen in the various contexts of medical training, can affect the way formative feedback is delivered (28), and student well-being, collegiality and compassion (26, 27). This is clearly an area that needs more attention and research.

This study aimed to investigate the student experience of assessing, and being assessed by, their cohort peers in a formative OSCE. Our peer assessed formative OSCEs were a feasible, and

low-cost method, for giving students a formative experience to help prepare them for their summative OSCEs. Students had the opportunity to practice under formal exam conditions and processes, and many stated that they had learnt much from the opportunity of being in the role of the assessor themselves. As an “assessor,” students were forced to grapple with some deeper aspects of learning related to their developing professionalism skills. While difficult to quantitate, these skills are important in the long term for safe future clinical practice.

Data availability statement

The original contributions presented in this study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by the Human Research Ethics Committee of the University of Wollongong approved these studies - Ref No's: 2017/030, 2018/010, & 2019/011. The studies were conducted in accordance with the local legislation and institutional requirements. The Ethics Committee/Institutional Review Board waived the requirement of written informed consent for participation from the participants or the participants’ legal guardians/next of kin because participants were informed ahead of time that their participation was voluntary and anonymous, and their completion of the survey was taken as tacit consent.

Author contributions

HR: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review and editing.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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"It actually helped": students' perceptions of feedback helpfulness prior to and following a teacher professional learning intervention

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This study investigated the effects of a teacher professional learning intervention, underpinned by a student-centred model of feedback, on student perceptions of feedback helpfulness. The study was conducted in the context of primary education English writing in Queensland, Australia. No overall differences in feedback perceptions of students in 13 intervention and 9 comparison schools were identified following the intervention. However, more detailed analyses revealed significantly greater increases in perceived helpfulness among intervention group students for six feedback strategies. This suggests the intervention changed teachers' feedback practices, enhancing student perceptions of feedback helpfulness. Student focus group data provided valuable qualitative insights into student feedback perceptions. Overall findings highlight the interrelatedness between feedback strategies across the feedback cycle for enhancing student learning.

KEYWORDS

feedback, student perceptions, teacher professional learning, primary education, mixed methods research methodology

1 Introduction

The use of feedback to enhance students' learning outcomes has been widely studied and is gaining much attention in educational practice and research (Winstone et al., 2017; Gotwals and Cisterna, 2022). Feedback is considered to be "among the most critical influences on student learning" (Hattie and Timperley, 2007, p. 102) because it plays a fundamental role in making students aware of how they can improve. Contemporary conceptualisations view feedback as involving bi-directional exchanges of information where the student is active, in contrast to a traditional transmissive approach with a focus on teachers providing feedback to passive student recipients (Hattie et al., 2016; Van der Kleij et al., 2019).

It is clear that the perspective of the learner is paramount given they must receive, interpret and act on feedback information in order to improve (Sadler, 1989; Hattie et al., 2016). However, empirical evidence on how feedback is perceived and used by school students is still

inconclusive (Gamlem and Smith, 2013; Brooks et al., 2019b; Van der Kleij and Lipnevich, 2021). Given the potential for feedback to improve learning, there is a need to understand how school students perceive and act upon feedback so as to improve classroom feedback practices.

1.1 Feedback potential

The aim of feedback is to assist learners to close the distance between where they are and where they need to be (Sadler, 1989; Hattie and Timperley, 2007). Hattie and Timperley (2007) described feedback as “information provided by an agent (e.g., teacher, peer, book, parent, self, experience) regarding aspects of one’s performance or understanding” (p. 81). Feedback can enhance learning when students engage with it to confirm, add to, strengthen, modify or expand their existing knowledge or strategy repertoires (Butler and Winne, 1995). As such, feedback can boost achievement, for example by encouraging students to adopt more efficient learning strategies (Hattie and Timperley, 2007).

Feedback research has long focused on trying to identify aspects that make feedback effective (Van der Kleij et al., 2019). However, what happens after students “receive” feedback is highly unpredictable, and the potential of feedback to improve student learning outcomes is often not realised. Kluger and DeNisi (1996), in a major review on the effects of feedback, found that feedback produced both positive and negative effects and attributed this variance to task characteristics and individual interpretations of feedback messages. Many feedback researchers now recognise that of critical importance is how feedback is received and eventually acted upon (Hattie et al., 2016; Van der Kleij et al., 2019; Lipnevich and Smith, 2022).

1.2 Contemporary perspectives of feedback: students as active in feedback processes

Conceptualisations of the role of the student in feedback have evolved considerably over the last five decades (Van der Kleij et al., 2019). Early conceptualisations saw feedback as a one-way transmission of information. This approach to feedback was reliant upon students valuing, understanding, and acting upon feedback, which was assumed as a given. However, research shows that in practice, one-way transmissive feedback rarely results in the intended learning improvements, but rather can result in student disengagement with the feedback process (e.g., Winstone et al., 2017).

Contemporary (social) constructivist and sociocultural models of feedback build upon feedback reciprocity, a two-way process between a feedback provider and recipient, enabling the student to be active in the process (Van der Kleij et al., 2019; Gulikers et al., 2021; de Vries et al., 2024). Winstone et al. (2017) use the term “proactive recipience” to refer to “a form of agentic engagement that involves the learner sharing responsibility for making feedback processes effective” (p. 17). Importantly, in contemporary models of feedback, students are positioned as active agents in the feedback process where they engage in continuous feedback interactions with the teacher, peers, and themselves, actively seeking, interpreting and

acting on feedback in order to self-regulate and improve their learning (e.g., Gulikers et al., 2021; Lipnevich and Smith, 2022; Veugen et al., 2024).

To realise sustainable feedback processes, teachers need to assist students in developing the capacity to self-regulate and actively engage with feedback to enhance their learning (Brooks et al., 2019a; Gulikers et al., 2021; de Vries et al., 2024). Hence, the feedback questions “*Where am I going?*” (feed up), “*How am I going?*” (feed back) and “*Where to next?*” (feed forward) (Hattie and Timperley, 2007), position the learner as central and active in the feedback process.

To effectively self-regulate, students first need to have a thorough understanding of the learning intentions. Further, they need to be able to evaluate how they, or their peers, are progressing in relation to the learning goals. This requires an understanding of what quality looks like (Wyatt-Smith and Adie, 2021). Simply announcing or transmitting learning goals and success criteria is not enough to assist students in developing these critical insights (Timperley and Parr, 2009; DeLuca et al., 2019; Gulikers et al., 2021). Rather, the co-construction of success criteria by teachers and students through the deconstruction of a range of models has been demonstrated to effectively develop students’ understandings of features of quality work (Brooks et al., 2021a,c; Wyatt-Smith and Adie, 2021).

Second, students need to be able to use feedback to reduce the distance between their current levels of progress in relation to the goal. Thus, students need to know *how* to improve (Hattie and Timperley, 2007). Research suggests that in practice, feedback is often insufficiently specific to enable students to take action (Van der Kleij and Lipnevich, 2021). Although students may prefer feedback that tells them how to improve, less individualised and specific feedback may in fact result in more productive learning, as it forces learners to engage more actively with the feedback message (Jonsson and Panadero, 2018). The major implication of these contrasting views is that students need to be empowered to decide which actions would be most appropriate in a certain context, and the degree of feedback specificity may need to be tailored to students’ levels of proficiency and self-regulatory capabilities.

Further, contemporary feedback research has highlighted the importance of students being active in the role of feedback providers, through peer and self-assessment (Van der Kleij et al., 2019; Lee et al., 2020). Ideally, students draw upon feedback from multiple sources, including teacher feedback, in shaping their understandings of what quality work looks like and undertaking peer and self-assessment (Wyatt-Smith and Adie, 2021). Importantly, the benefits of peer and self-assessment are interdependent; peer-assessment has been demonstrated to result in substantial learning gains in both receivers and providers of peer feedback (Huisman et al., 2018). Namely, student participation in peer feedback processes encourages the application of critical thinking skills to detect aspects for improvement and introduces students to diverse responses and methods, encouraging transfer of ideas for self-assessment and subsequent revision of their own work. Research suggests that teacher guidance is fundamental to the successful implementation of peer and self-assessment (e.g., Timperley and Parr, 2009; DeLuca et al., 2018; Lee et al., 2019). For example, findings of recent research showed that when teachers guided students in providing and using peer feedback, students perceived peer feedback as beneficial to their learning (Lee et al., 2019).

1.3 Student perceptions of feedback

Studies examining student perceptions of feedback have focused on a broad range of variables, such as perceived usefulness, effectiveness or quality in relation to feedback characteristics such as timing, amount, valence (positive versus negative) and specificity (Van der Kleij and Lipnevich, 2021; Lipnevich and Smith, 2022; Winstone and Nash, 2023). Overall, research evidence on student feedback perceptions has produced limited meaningful findings, which is partly due to a lack of common theoretical foundations (Van der Kleij and Lipnevich, 2021). For example, Van der Kleij and Lipnevich (2021) point to a lack of consistency in research approaches to examining student feedback perceptions, which makes it difficult to compare results and generate useful insights. Winstone and Nash (2023) identified that the outcomes of many studies pointed to the need to develop more in-depth understanding of the “mechanisms underlying effective feedback” (p. 120). One key area of focus is understanding student processes for engagement with feedback, and their perceptions of which feedback strategies are helpful, and why.

Despite inconsistencies in research evidence, research points to the importance of how useful or helpful students perceive feedback to be (Van der Kleij and Lipnevich, 2021). For example, several studies have reported a positive relationship between student perceptions of feedback usefulness and their achievement levels [e.g., Rakoczy et al., 2013; Harks et al., 2014; Brooks et al., 2021b] or self-reported achievement outcomes (Mapplebeck and Dunlop, 2019; Van der Kleij and Lipnevich, 2021). However, various studies have suggested that teachers generally perceive their feedback to be more useful than their students (e.g., Havnes et al., 2012; Gamlem and Smith, 2013). Reasons reported in research for a lack of perceived helpfulness include a lack of detail in feedback, lack of understanding of the meaning of feedback, feedback that is not useful beyond a specific task, or feedback that comes too late (Gamlem and Smith, 2013; Mapplebeck and Dunlop, 2019; Lipnevich and Smith, 2022).

How students are positioned to act in the feedback process also influences how they perceive feedback. In a study in secondary science education, students identified that feedback that required them to think and develop independence was helpful, rather than the teacher presenting information to them (Mapplebeck and Dunlop, 2019). However, not all students may want to take an active role, which can pose challenges for teachers trying to shift responsibilities in the feedback process (Jonsson et al., 2015). Considering the ultimate goal of feedback in the formative assessment process is crucial to enabling effective classroom practices (Gulikens et al., 2021). Thus, a critical question for classroom practice is how teachers can design feedback processes so that feedback is perceived as helpful by students and drives students' active use of feedback to progress their learning.

1.4 Professional learning interventions for teachers in effective feedback

As noted, conceptualisations of feedback in the literature have shifted from a transmissive to a student-centred perspective (Van der Kleij et al., 2019). How teachers construct feedback interactions will have a major impact on how students are positioned to engage in feedback processes (Mapplebeck and Dunlop, 2019; Van der Kleij et al., 2019). Implementing feedback practices with a student-centred

perspective will require a shift in thinking and practices for many teachers as well as students (Brooks et al., 2021a,c; Jonsson et al., 2015; DeLuca et al., 2019). Substantial professional learning (PL) interventions may be needed to enable teachers to realise such a shift (Jonsson et al., 2015; Voerman et al., 2015; DeLuca et al., 2018, 2019; Mapplebeck and Dunlop, 2019).

PL interventions in feedback have yielded mixed success, with some reporting positive impacts on changes in feedback practices (Voerman et al., 2015), and others reporting moderate impact with difficulties in shifting traditional teacher-student interactions and positioning within the formative assessment process (Jonsson et al., 2015; Gulikers and Baartman, 2017; DeLuca et al., 2018, 2019). For example, Jonsson et al. (2015) reported on the implementation of a large-scale professional development project focused on Assessment for Learning, in which feedback plays a critical role. Their results showed that although teachers had reported positive changes to their classroom practices, many struggled to shift towards shared responsibility for assessment and feedback. As a result, students remained passive receivers of highly directive teacher feedback, and were not engaged in supporting their own and peers' learning. These findings point to the difficulties in moving away from traditional teacher-dominated orientations to assessment practice. Consistent with these findings, various studies have concluded that shifting towards student-centred feedback practices is considered advanced formative assessment practice (e.g., DeLuca et al., 2019; Gotwals and Cisterna, 2022; de Vries et al., 2024). However, there is a lack of research on how teacher PL can be shaped to enhance effective feedback processes in which students are active.

1.5 Contribution and research questions of the present study

Much of the research on teacher PL in feedback has relied on teacher self-report data (Voerman et al., 2015), failing to consider the perspectives of students as key actors. Given the central role of students in feedback, the success of PL interventions in feedback ultimately depends on how helpful feedback practices are to students. Nevertheless, there do not appear to be any studies on feedback perceptions that take account of changes in student perceptions following PL interventions (Van der Kleij and Lipnevich, 2021). To address this gap in the literature, this mixed methods study drew primarily on quantitative data from a survey instrument, which was administered to an intervention and comparison group prior to and following PL in feedback. Qualitative student focus group data were used to complement the quantitative data, to gain detailed insights into which feedback strategies were perceived as more or less helpful by students, and importantly, why. Findings provide critical new insights into how PL may assist teachers in facilitating feedback practices that are perceived as helpful by students.

The present study examined the effects of a teacher PL intervention on student perceptions of feedback helpfulness. The PL intervention was underpinned by a student-centred model of feedback (Brooks et al., 2021a), which was developed based on (social) constructivist and sociocultural models of feedback, expanding the widely-used Hattie and Timperley (2007) feedback model. We hypothesised that training teachers in effective feedback would result in increased perceived helpfulness among students, because students being active

in the feedback process would make them more able to effectively act on the feedback.

The following research questions guided the study:

- 1 Did the PL intervention change students' perceptions of feedback helpfulness?
- 2 Which feedback strategies were perceived as more or less helpful following the PL intervention, and why?

2 Method

2.1 Research context and PL intervention

This study was part of a larger three-year study (blinded for review), investigating the effects of a PL intervention underpinned by a student-centred model of feedback upon instructional leadership, teacher practice and student learning outcomes. The larger study included a series of studies, with each year focusing on a different schooling year level (grade) and investigative focus. The intervention was contextualised within the subject of English, specifically writing. This study focused on student perceptions of a range of feedback strategies that are used in the intervention.

The intervention was implemented using a student-centred model of effective feedback [Author(s)]. This feedback model is based on the well-known model by Hattie and Timperley (2007), which posits that effective feedback processes revolve around three questions: "Where am I going?" (making learning goals explicit; feed up), "How am I going?" (assessing progress relative to the goals; feedback), and "Where to next?" (determining subsequent steps to achieve the goals and progress learning; feed forward). In our model, these questions have been translated into a classroom-level feedback cycle, consisting of three stages: (1) clarify success, (2) check in on progress and (3) promote improvement. These feedback processes make up the 'inner wheel' of the model. Acknowledging the importance of conditions beyond the classroom, a second level, referred to as the 'outer wheel', focuses on conditions at the whole school level. These conditions may enable or hinder implementation of effective feedback practices within a school. Key conditions within our model include:

- *Shift thinking*, from traditional conceptions of the roles of teachers and students in feedback practices, to a student-centred perspective, where teachers play a key role in activating learners
- *Reviewing practice*, aligning pedagogy with the prescribed curriculum and success criteria
- *Build a learning culture*, creating a culture of learning where there is a shared understanding about the purpose of feedback, and its role in the learning process.

The comprehensive intervention consisted of eight half-day collaborative PL sessions spaced across one school semester (6 months), as well as allocated collaboration and planning time for teachers and leaders. In addition, the research team provided on-demand support for school leaders, who were guided in providing ongoing support within their school. The intervention was supported by a resource book, which evolved around the student-centred feedback model. The PL sessions were led by two experienced

facilitators with teaching and leadership expertise. These sessions aimed to enhance teachers' capabilities in facilitating effective feedback processes, where students are active. Teachers and leaders worked collaboratively within and between sessions, supporting one another's practice. The PL facilitators guided participants in implementing changes in feedback practices.

The intervention was structured around the student-centred feedback model, starting with the outer wheel to establish effective feedback conditions within the school. These sessions included discussions to develop a shared learning philosophy, discussions about the potential benefits of active student engagement in feedback processes, and interrogating curriculum standards to determine the kinds of thinking required in assessment tasks to demonstrate achievement of these outcomes. Follow-up sessions focused on the inner wheel, targeting detailed feedback processes. For example, discussions focused on how teachers could help clarify what success looks like with students. Various resources were used to illustrate how teachers may enable students to be active in the feedback process. For example, teachers were encouraged to develop *models* of different levels of quality, to illustrate quality features as well as common misconceptions. Teachers were then encouraged to use these models to stimulate student thinking about quality features, and co-construct success criteria. A culminating resource, containing models as well as explicit criteria, are 'bump it up walls'. Teachers were guided in how to construct these walls, in collaboration with their students. Various other feedback strategies, such as peer feedback, were discussed and modelled during the collaborative PL sessions.

2.2 Participants

Participants were recruited through purposive sampling of 22 state primary schools from a Metropolitan Region in Queensland, Australia. School selection was linked to school interest in PL in feedback and writing as a school improvement priority. Thirteen schools participated as partners and took part in the intervention. Nine schools served as a comparison group. To incentivise participation, these comparison schools participated in a one-off PL session on effective feedback practice. For this reason, this group is referred to as the 'comparison' and not 'control' group. Participating schools represented a range of socio-educational advantage student populations, with intervention schools having on average slightly higher Index of Community Socio-Educational Advantage (ICSEA) values (ranging from 956 to 1,179).

This study employed purposive sampling to select Year 4 students (aged 8–9 years) from 22 schools, which were either in the intervention or comparison group. To ensure the robustness of the quantitative analyses, an a priori power analysis was conducted. This analysis identified a minimum requirement of 200 observations (100 per group), to achieve a power ($1-\beta$) of 0.80. When increasing the power to 0.90 while maintaining the other parameters, the minimum sample size rose to 265 observations in total.

Data were collected from students who had provided written informed consent (student assent as well as parental/carer consent) from 68 classes (intervention $n = 52$; comparison $n = 16$). Additionally, a small number of Year 5 (aged 10–11 years) students in composite Year 4/5 classes, who were completing the same learning tasks as their

Year 4 peers, were also included. The number of participants in the pre-survey was 1,255 (intervention $n = 985$ comparison $n = 270$). A total of 1,197 students completed the post-survey (intervention $n = 974$; comparison $n = 223$). Both samples exceeded the minimum sample size identified in the power analysis. For the qualitative component of the study, a sub-sample of 33 Year 4 students (3 per school in eleven intervention schools) were randomly sampled to participate in focus group interviews. Given the random sampling approach, these students were not necessarily from the same class within a school.

2.3 Procedures and instruments

The study used an explanatory mixed methods design, with concurrent collection of quantitative and qualitative data (Creswell and Plano Clark, 2018). A quasi-experimental research design was adopted for the quantitative study component, with the qualitative component focusing only on students in the intervention group. The comparison schools participated in an introductory presentation session on effective feedback identical to that of the partnering schools, but did not take part in the PL intervention. Figure 1 provides an overview of the study procedures and data collection for the study. As outlined in Figure 1, data collection instruments included a student feedback perceptions survey pre-and post the PL intervention, and student focus groups.

2.3.1 Student feedback perceptions survey

The survey, administered by each teacher to their class at the beginning and end of the school semester, aimed to measure student perceptions of how helpful different feedback strategies were to their learning. Thus, student perceptions of feedback helpfulness as measured in the present study reflect their overall self-reported recollection of past experiences (Van der Kleij and Lipnevich, 2021). By comparing student ratings prior to and following the PL intervention, the data provide insights into the perceived usefulness of feedback strategies and how they are implemented. The survey was designed based on an existing survey for older students which was administered as part of the broader research study. For the current study, a new succinct survey incorporating key feedback strategies was designed to suit the Year 4 age group. The new 15-item survey addressed the interconnected elements of feed up, feed back, and feed

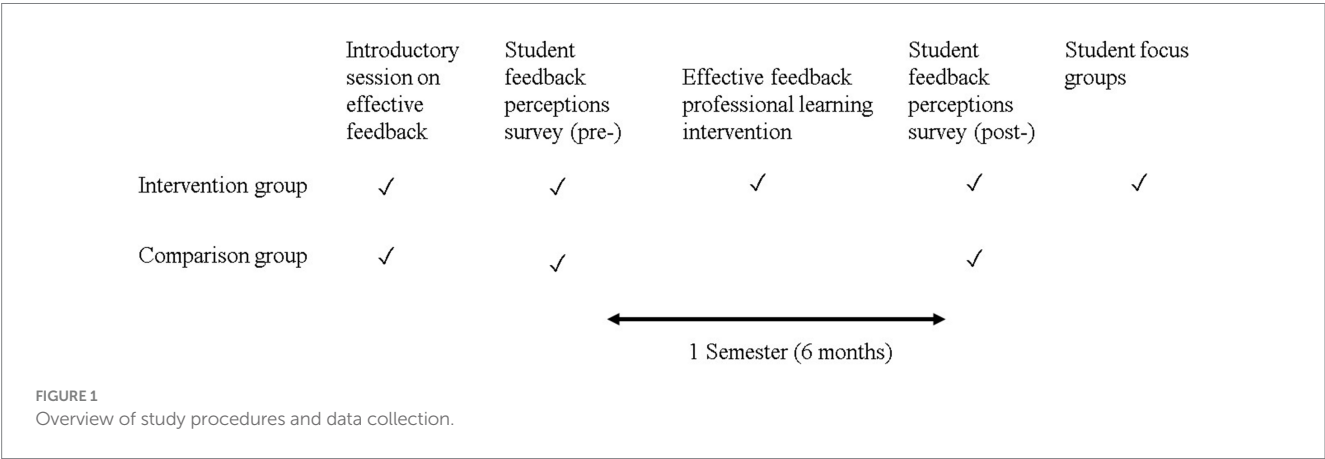
forward (Hattie and Timperley, 2007) of the student-centred feedback model (Brooks et al., 2021a).

The three feedback questions (Hattie and Timperley, 2007) were contextually modified to: “What does success look like in English?”; “What progress are you making in English?”; and “How can you improve in English?” Four items pertaining to helpfulness of different feedback strategies were generated for each feedback question. For example, item one asked participants “How helpful are success criteria at showing you what success looks like in English?” The survey incorporated a range of strategies from the feedback PL intervention. In particular, items addressed strategies that promoted the learner to be active, rather than passive, with many of these strategies emphasising the interconnectedness of the student-centred feedback model. Strategies perceived as more traditional and not aligned to the intervention—such as issuing marking guides or criteria sheets to students—were also included to ensure comprehensive representation of strategies. Students were required to rate the helpfulness of each feedback strategy on a scale of 1–7, with 1 being “not helpful” to 7 being “extremely helpful.” In cases where students were not familiar with a feedback strategy or their teacher did not use the strategy, a box labelled “do not use” could be ticked.

In addition, students were asked to rate their capability for each element of the feedback cycle (3 items). For example, students were asked: “Overall, how well do you know what success looks like in English?”

Item construction and selection was based on a review of feedback literature and previous research (Brooks et al., 2019b), as well as the researchers’ own experiences in the previous year of the study. Prior to implementation, face validity of the survey was established with students, teachers and school leaders.

To validate the survey instrument, data from a Year 5 cohort (not included in the present study) were first used to explore the underlying factor structure. Only cases with valid responses were considered in these analyses (i.e., excluding students with any missing responses, or who responded “do not use” to any of the items). These analyses revealed the presence of two factors, with most of the variance explained by the first factor. The second factor consisted of the “overall” items addressing self-reported capability in each element of the feedback cycle, with items cross-loading onto the first factor. These cross-loading items were removed, resulting in a one-factor solution. Exploratory factor analysis results were then tested through a confirmatory factor analysis using Year 4 data.



Finally, tests of longitudinal invariance were performed to ensure consistency in the measurement of the feedback perceptions construct across pre-and post-survey administrations. Model fit and scalar invariance were satisfactory, with each item exhibiting a loading of 0.4 or greater.

The 12 individual items making up the perceived helpfulness of feedback scale showed substantial Cronbach's alpha reliabilities for both pre-and post-intervention administrations (pre-intervention: $\alpha = 0.87$, $n = 692$; post-intervention: $\alpha = 0.89$, $n = 987$). The perceived helpfulness of feedback scale was constructed by taking the average of the 12 items for observations with valid responses on each item (pre-intervention $n = 665$; post-intervention $n = 953$). Scaled scores were not calculated for students with at least one "do not use" response, as these responses could not be quantified in the same way as the other responses. These responses could also not be considered missing at random, as they represented valid responses of a different order. These cases were therefore analysed separately, which provided some insights into strategies that were used more frequently following the PL intervention (see [Supplementary material](#)).

2.3.2 Student focus groups

To obtain detailed qualitative data about how and why elements of the feedback intervention were perceived as helpful by students, a semi-structured focus group interview ([Creswell and Poth, 2018](#)) was conducted with intervention group students. Interview questions focused on how or why classroom feedback practices emanating from the PL intervention were helpful to student learning. Due to the semi-structured nature of these interviews, the exact questions asked varied. For example, students were asked to elaborate or explain their responses, or respond to their peer's contributions. The focus group interviews were led by the first two authors and were audio recorded. The duration of the focus groups ranged from 8 to 15 min.

2.4 Data analysis

All survey data were quantitatively analysed using multilevel modelling to account for students being nested in 68 classes taught by different teachers ([Hayes, 2006](#)). A multilevel approach is particularly appropriate in this context as it accounts for variation in teachers' implementation of the intervention. A linear mixed model was used to compare intervention and comparison group students' scaled scores of feedback helpfulness perceptions, prior to and following the intervention (addressing RQ 1). Next, item-based linear mixed model analyses were conducted to identify which strategies were perceived as more or less helpful following the PL intervention (addressing RQ 2).

Based on the feedback strategies that were perceived as significantly more or less helpful following the intervention, qualitative focus group data were thematically analysed. Analyses of student focus group data were used to provide information to explain the quantitative findings, and shed further light on which feedback strategies were perceived as more or less helpful following the PL intervention, and importantly, why (addressing RQ2). A narrow coding framework was developed by author one, based on quantitative analyses and the student-centred feedback model used in the intervention. Inter-rater reliability of coding was established between authors one and two, over two rounds of blind double coding (comprising 27% of overall data) using NVivo 12 (2018). These

authors collaboratively evaluated the independent coding after each round. This process increased inter-rater reliability from substantial (first round: 96.96% agreement, Cohen's Kappa = 0.77) to almost perfect agreement (second round: 97.76% agreement, Cohen's Kappa = 0.88). Following establishment of rater reliability, remaining data were coded by author one and cross checked by author two. Author three narratively synthesized coded data to establish key findings.

3 Results

The following sections present the results of the student feedback perceptions survey, followed by an analysis of student focus group data to complement the quantitative results. To enhance readability, only statistical analyses in relation to the main findings are presented, with further detail provided in the [Supplementary material](#).

3.1 Survey results: comparison of student perceptions of feedback helpfulness

[Table 1](#) presents the mean survey scaled scores for the intervention and comparison group, pre-and post-intervention. The results show that students in the intervention and comparison group overall perceived feedback to be mostly helpful across both survey administrations.

Although student perceptions of feedback helpfulness had increased slightly from pre- to post-intervention, multilevel analyses revealed no statistically significant differences between the intervention and comparison group ($\beta = 0.13$, $z = 1.17$, $p = 0.242$). Since the scale was composed of items measuring perceived helpfulness of a range of feedback strategies, including strategies that were not a focus of the intervention, item-level analyses were conducted to more closely examine the data.

To answer the second research question, item-level responses ([Table 2](#)) were examined to identify which feedback strategies were perceived as more or less helpful following the PL intervention. Descriptive statistics showed that with the exception of the use of *marking guides*, all feedback strategies were perceived as more helpful by students in the intervention group post-intervention compared to pre-intervention. Of note, the use of *marking guides* was not endorsed in the PL intervention, as this strategy does not require active student engagement.

The largest positive change in perceptions in the intervention group was observed for items addressing use resources and improvement walls. These students also perceived models, success

TABLE 1 Student perception survey mean scaled scores for the intervention and comparison group prior to and following the intervention.

Group	Pre-intervention			Post-intervention			Change
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>M</i>
Intervention	540	4.68	1.02	800	4.80	1.07	0.12
Comparison	125	4.72	0.94	153	4.79	1.06	0.07

TABLE 2 Mean ratings of helpfulness by feedback strategy and item-level multilevel analysis.

Survey items and item labels displayed in bold	Intervention group		Comparison group		β^a
	Pre-intervention <i>M</i> (SD)	Post-intervention <i>M</i> (SD)	Pre-intervention <i>M</i> (SD)	Post-intervention <i>M</i> (SD)	
How helpful are success criteria at showing you <i>what success looks like</i> in English?	4.17 (1.61)	4.47 (1.64)	4.48 (1.51)	4.38 (1.58)	0.47*** (3.43)
How helpful are models at showing you <i>what success looks like</i> in English?	4.36 (1.71)	4.67 (1.65)	4.79 (1.45)	4.68 (1.69)	0.42*** (2.82)
How helpful are marking guides at showing you <i>what success looks like</i> in English?	4.32 (1.75)	4.30 (1.82)	4.68 (1.60)	4.59 (1.73)	0.04 (0.24)
How helpful are improvement walls at showing you <i>what success looks like</i> in English?	4.36 (1.82)	4.82 (1.73)	4.41 (1.67)	4.33 (1.80)	0.63** (3.17)
How helpful is feedback on pre-assessments at showing you <i>the progress you are making in English</i> ?	4.53 (1.66)	4.60 (1.71)	4.70 (1.61)	4.86 (1.62)	−0.04 (−0.28)
How helpful is feedback on drafts at showing you <i>the progress you are making in English</i> ?	4.78 (1.70)	4.86 (1.60)	4.77 (1.60)	4.91 (1.59)	−0.08 (−0.57)
How helpful is feedback on work in class at showing you <i>the progress you are making in English</i> ?	4.65 (1.59)	4.86 (1.50)	4.85 (1.55)	4.99 (1.41)	0.19 (1.38)
How helpful is feedback during class discussions at showing you <i>the progress you are making in English</i> ?	4.47 (1.66)	4.60 (1.69)	4.75 (1.62)	4.79 (1.63)	0.13 (0.87)
How helpful are comments from the teacher about <i>how you can improve in English</i> ?	4.99 (1.62)	5.21 (1.51)	5.30 (1.46)	5.28 (1.48)	0.28* (2.16)
How helpful is talking with peers about <i>how you can improve in English</i> ?	3.99 (1.78)	4.26 (1.75)	4.26 (1.54)	4.01 (1.74)	0.61*** (3.91)
How helpful is it when you use resources, e.g., the success criteria, models or improvement walls to see <i>how you can improve in English</i> ?	4.58 (1.72)	5.08 (1.61)	4.89 (1.67)	4.88 (1.64)	0.58*** (3.94)
How helpful is it when you get to ask questions about <i>how you can improve in English</i> ?	4.85 (1.70)	4.96 (1.67)	5.08 (1.55)	4.98 (1.73)	0.26 (1.66)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Boldfaced numbers indicate statistically significant differences between intervention and comparison groups over time. ^a β 's represent coefficients of the interaction term between dummy-coded treatment (1 = intervention, 0 = comparison) and time (0 = pre-intervention, 1 = post-intervention) in the multilevel regressions. Figures in parentheses contain z-statistics. Number of students with non-missing responses per item ranged from $n = 241$ to $n = 292$ in the comparison group, and $n = 1,069$ to $n = 1,102$ in the intervention group. Total number of valid observations per item (i.e., pre-and post-data) ranged from $n = 343$ to $n = 490$ in the comparison group, and $n = 1,628$ to $n = 1,943$ in the intervention group.

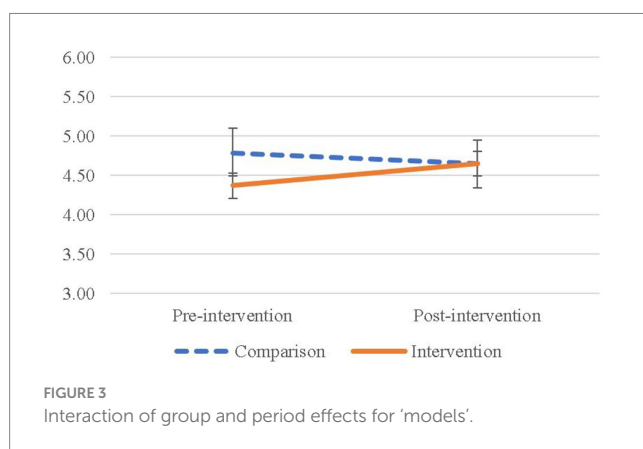
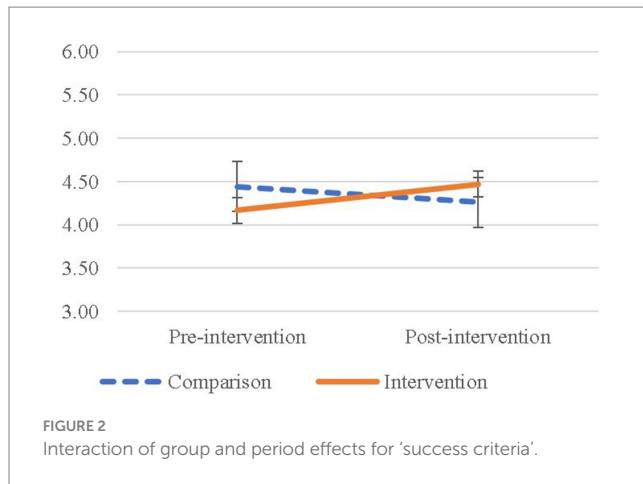
criteria, and feedback from the teacher and peers about how to improve as more helpful following the intervention. Comparison group students perceived these strategies as relatively less helpful. Results from the multilevel regressions (Table 2) showed that for items addressing success criteria (Figure 2), models (Figure 3), improvements walls (Figure 4), teacher (Figure 5), peers (Figure 6), and use resources (Figure 7), the intervention group showed statistically significant greater increases in perceptions of helpfulness than the comparison group. Next, qualitative data from student focus groups were analysed to provide in-depth insights into which feedback strategies were perceived as more or less helpful after the PL

intervention, and student explanations of why feedback strategies were or were not helpful.

3.2 Focus groups: perceived helpfulness of specific feedback strategies

3.2.1 Helpfulness of success criteria at showing students what success looks like in English

Students identified success criteria were helpful to them because these clearly outlined the requirements for success, and hence what

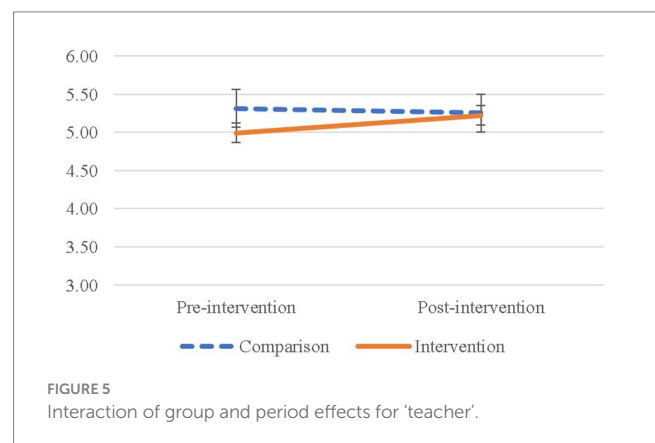
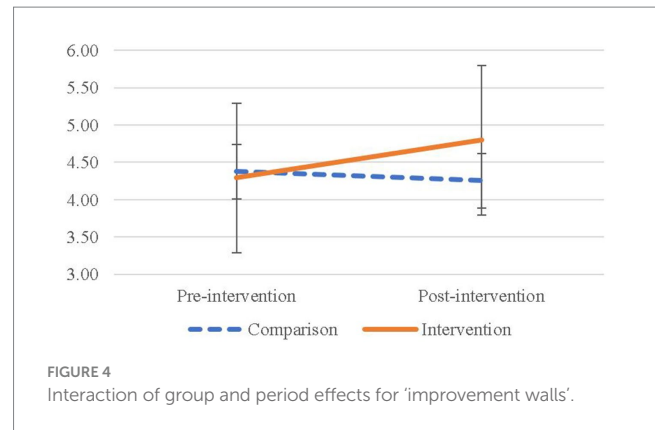


they needed to do to perform well. Success criteria enabled students to see what they needed to do to “work your way up.” Students demonstrated a thorough understanding of the criteria and features of quality. For example, they identified using meta-language, language features, and demonstration of higher-order skills such as comparing and explaining, as features of quality.

Students reported a variety of approaches used by teachers to ensure there was a shared understanding of the success criteria. These strategies included: (1) critiquing, sorting and discussing work samples, to identify the markers of success and quality (success criteria). (2) teacher-led classroom discussions to enable students to engage with and understand the success criteria. For example, students noted their teacher “puts into our words, so we can understand it and have a better understanding of what we need to do,” and “we get the success criteria and we compare our work to it,” and (3) collaborative goal setting, challenging students to improve their work by demonstrating how they could apply the criteria to identify aspects for improvement and next steps. It was clear from students’ responses that teacher support was perceived as critical in making success criteria helpful. Further, the focus group data shows the helpfulness of success criteria was linked to the use of models and improvement walls.

3.2.2 Helpfulness of models at showing students what success looks like in English

Students indicated that models were helpful in demonstrating what quality work looked like. Teachers used a variety of approaches



to demonstrate different degrees of success by purposefully contrasting two or three models of varying quality. Importantly, teachers actively engaged students in the process of clarifying success using these models. For example, teachers placed students in small groups, and asked them to evaluate which model was better and why, and facilitated critical discussions about quality. Teachers would sometimes use students’ own work as samples for these discussions. As one student indicated, such discussions would focus on: “someone who wrote a good report and someone who wrote an okay report; and we compare and see which one is better.” By discussing quality in a constructive yet supportive manner, teachers were successful in making models helpful to students to guide their learning.

3.2.3 Helpfulness of improvement walls at showing students what success looks like in English

Students identified that improvement walls (also referred to as bump it up wall or similar)—a continuously available but ever-evolving resource in the classroom which visually matches the success criteria and models—provided a helpful reference point to clarify what success looked like. Teachers used a variety of approaches to construct these improvement walls, often in collaboration with students. To make the improvement walls appealing to students, teachers used metaphors such as the “road to success,” with cars representing features of quality “to get to the end of the road.” Students identified that they consulted the improvement wall regularly to remind themselves of quality features. One student stated that the improvement wall was

particularly helpful in ensuring they kept in mind what quality looked like, without having to remember all the orally discussed quality features.

3.2.4 Helpfulness of teacher comments about how students can improve in English

Teachers used a variety of approaches to help students improve. This included whole class critiques using student work samples. For example, a student identified that:

Our teacher does it with the whole class; puts it up on the board and then we can see how they can improve their work; and then it gives us a better idea of how we work in our own work.

Some students also identified that their teacher demonstrated how to improve by collaboratively editing and improving the focus work sample (see 3.2.2), thereby highlighting strategies for improvement.

Although teacher feedback about how they can improve was perceived as important by most students, the teacher was often not their first point of reference. The improvement wall and peers (3.2.5 and 3.2.6) also played an important role in helping students determine next steps. Students identified that teacher feedback was particularly helpful when they found something “tricky” or something was not on the improvement wall, or they needed more specific guidance on what to do; “When you get to your teacher, you can get into the deeper knowledge of what you need to do”.

Students generally perceived teacher feedback on how to improve as helpful, yet several students identified that they did not always understand this feedback. One student indicated that self-assessment was critical in understanding and being able to use teacher feedback, as this enabled them to “see where you are at and you can improve using what they have said”.

3.2.5 Helpfulness of peer discussions about how students can improve in English

Students identified that talking to peers about how they can improve was very helpful. This helped them identify areas for improvement and check for completeness, and gave them ideas on how to improve and refine their understandings.

Peer assessment was organised in a number of different ways. Students worked in pairs to evaluate each other’s work and provide feedback focused on areas for improvement, often prior to requesting teacher feedback. Peer assessment was also organised in small groups, sometimes asking students to sort student work samples to assess their quality and provide feedback to promote improvement using the criteria. Students indicated that sharing knowledge amongst group members was helpful to enhance their own understanding. Sharing their work and being open to feedback was perceived by one student as critical to improvement; “we look at other people’s work and see what they have and if we can add anything to our work”.

Students indicated that at times it was helpful to ask a peer rather than the teacher for help, for various reasons. For example, teachers were not always available to answer questions, or peers may be better at explaining the next steps in language students can understand. For example, one student reflected:

My teacher uses lots of big words that I don’t understand. She’s like, “Oh, you should add more blah, blah, blah,” and I’m like, “What? I don’t get what you mean.” And then I go to a friend and I understand her much better.

Students appeared to value peer feedback greatly, which they identified was generally honest and helpful in guiding students how to make their work better, one step at a time. Notably, several students identified that peer assessment was helpful for their self-assessment. For example, one student noted that by reading and providing feedback on their peer’s work, “you can see how they are going and how you are going, to compare; see who has more detail. And then you realise you have to get to their standard.” Reading other students’ work also gave students new ideas for improving their own work.

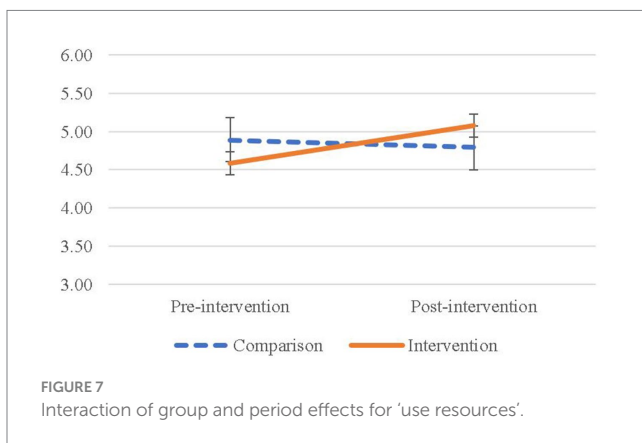
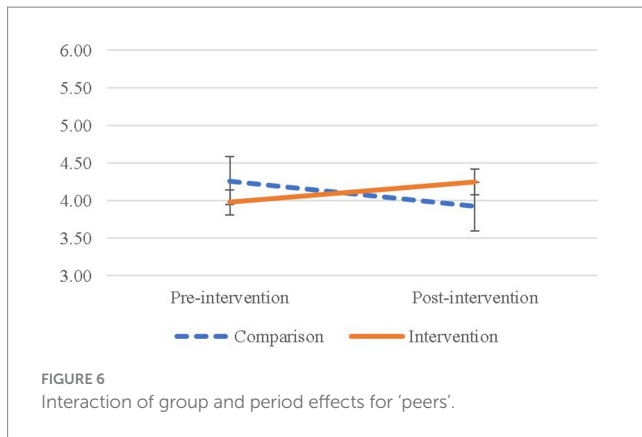
3.2.6 Helpfulness of resources to help students identify how they can improve in English

Students identified that resources used in their classroom were helpful in assisting them to identify how they can improve, through processes of self-and peer assessment. Specifically, students were able to use the success criteria, models and improvement walls to self-assess their work to determine where they were at, identify aspects for improvement, and determine next steps to take. Students perceived that resources were helpful in giving them ideas for how to improve their work. For example, one student reflected that “you can compare your work and see what you need to add to make your work better.” Students also emphasised the helpfulness of examples on the improvement wall to scaffold their writing. They highlighted the importance of the improvement wall being available at all times, so they could use it to improve their work as an ongoing feedback loop. Importantly, the improvement wall appeared to have challenged students to set goals to further improve their work, as it facilitated breaking down how to improve into manageable steps.

4 Discussion

This study examined the effects of a teacher PL intervention underpinned by a student-centred model of feedback on student perceptions of feedback helpfulness. It sought to answer two research questions: (1) Did the PL intervention change students’ perceptions of feedback helpfulness? And (2) Which feedback strategies were perceived as more or less helpful following the PL intervention, and why? We hypothesised that training teachers in effective feedback would result in increased perceived helpfulness among students, because students being active in the feedback process would make them more able to effectively act on the feedback.

The findings showed no overall differences in student feedback perceptions prior to and following the PL intervention. However, item-level analyses showed statistically significant differences in perceived helpfulness between intervention group students and comparison group students for six feedback strategies. Students in the intervention group perceived these strategies as more helpful following the intervention. Three of these feedback strategies focused on feeding up, the remaining three focused on feeding forward. None of the feedback strategies were perceived as less helpful following the intervention. These findings show the potential for PL interventions to impact teacher classroom practices and (student perceptions of)



feedback helpfulness for learning. Moreover, our findings demonstrate that activating students in feedback processes can successfully be achieved with students in lower primary education. Qualitative student focus group data were analysed to provide in-depth insights into the findings from quantitative analyses.

Students in the intervention group perceived three strategies for feeding up (Hattie and Timperley, 2007) as significantly more helpful following the intervention compared to those in the comparison group: success criteria, models, and improvement walls. The intervention strongly encouraged teachers to use these strategies in combination, due to their interdependent nature. We believe that the process of mapping the success criteria onto models, and deconstructing models using success criteria was what made things “stick” for students. In other words, clarifying success and using models go hand in hand. The improvement walls proved to be a useful vehicle to combine the strengths of each of these strategies, ensuring continued access to essential resources and information for students. The intention was for improvement walls to be fluid in nature, drawing on understandings of quality as these were gradually co-constructed. Although metaphors were helpful in making the improvement walls look appealing, the key to their success was the extent to which they aligned with ever-evolving notions of what quality looks like. These findings corroborate prior research highlighting the value of co-constructing criteria (Wyatt-Smith and Adie, 2021).

Importantly, the interviewed students demonstrated a thorough understanding of the criteria, which appears to be critical for students to perceive criteria as helpful. This finding sharply contrasts those in many previous studies (e.g., Timperley and Parr, 2009; DeLuca et al.,

2018), where criteria may have been announced by the teacher and referred to, but not actively engaged with by students. Students reported several approaches used by teachers to achieve shared understandings of the success criteria. These strategies included (1) critiquing, sorting and discussing work samples, (2) teacher-led classroom discussions to enable students to engage with and understand the success criteria, and (3) collaborative goal setting. Teachers were encouraged to spend considerable time actively involving students in the ongoing process of co-constructing success criteria to enable them to have a deeper understanding of their purpose and intent (DeLuca et al., 2019; Brooks et al., 2021a). This ongoing process was crucial in building students' capability to effectively self-and peer assess.

Further, following the intervention, three strategies for feeding forward (Hattie and Timperley, 2007) were perceived as significantly more helpful by students in the intervention group compared to those in the comparison group: teacher comments, peer discussions, and resources that help students in how to move forward. The qualitative results showed that students perceived these strategies as helpful at different stages of the feedback cycle, with improvement walls being a first point of reference throughout the cycle. These findings suggest that students were active in self-regulating their learning to determine next steps. Nevertheless, students continued to value teacher comments. Using a combination of strategies for identifying how to improve appeared to have enabled students to engage effectively and efficiently with feedback, lifting the burden of feedback for improvement off the teacher. This finding is encouraging in light of previous research, which identified difficulties in shifting responsibility for feedback from teachers to students (Jonsson et al., 2015; DeLuca et al., 2018, 2019).

We believe that the more effective use of certain strategies by teacher is only one reason for increased perceived helpfulness of these strategies by students. Another possible explanation is that teachers and students openly discussed feedback strategies, providing students more insights into their value for their learning. Such discussions provide an important starting point for changing how students are positioned to act in feedback processes, which is determined by how teachers construct their feedback practice (Mapplebeck and Dunlop, 2019; Van der Kleij et al., 2019). In addition, they enhance shared understandings of the purpose of feedback, as per the ‘build a learning culture’ in the student-centred feedback model's outer wheel (Brooks et al., 2021a).

Given the young age of participating students, the positive findings in relation to perceived helpfulness of peer feedback and improvement walls, demonstrating strong self-regulatory capacities, are particularly noteworthy. However, we would like to stress the interconnected nature of the feedback strategies addressed in the intervention. For example, for peer feedback practices to be effective, students first need to develop an understanding of what quality looks like. Clarifying success is therefore a fundamental first step. Further, younger students will require significant support to enable them to formulate helpful feedback that is aligned with success criteria (DeLuca et al., 2018; Lee et al., 2019). In contrast to previous research (DeLuca et al., 2018; Lee et al., 2019), interviewed students did not report issues with the trustworthiness or helpfulness of peer feedback. The intervention encouraged teachers to guide students in how to provide peer feedback, by focusing on the key success criteria. We believe that this approach contributed to the perceived helpfulness of peer feedback. The findings further

suggest that peer assessment was perceived as beneficial by feedback receivers, but also provided benefits to feedback providers, consistent with previous research (DeLuca et al., 2018; Huisman et al., 2018). Students indicated applying new insights from reading their peer's work to their own work, suggesting that peer assessment sparked self-feedback.

4.1 Limitations and implications for future research

Some limitations need to be acknowledged. An initial limitation was that purposive rather than random sampling may have introduced bias into the findings in the quantitative component of the study. This limitation was due to the research design with intervention schools already receiving treatment as part of the wider study.

Furthermore, perceived helpfulness of feedback in intervention and comparison schools was already high pre-intervention, which limited the study's ability to detect changes in perceived usefulness. There were also limitations in respect to the survey and the use of self-report data. Mechanisms were put in place to ensure age-appropriate procedures for data collection which proved effective as demonstrated by the high reliability values. The nature of the survey required excluding participant responses that selected "do not use" for one or more items, which reduced the sample size. The comparison group was of a smaller size than the intervention groups due to difficulties recruiting schools to join this condition, which reduced statistical power. Nevertheless, sample sizes were deemed sufficiently large to detect any significant overall or item-level effects. In addition, the findings only tell us that certain feedback strategies were perceived as more helpful, but not how effective this feedback was as evidenced by improved student achievement outcomes. Another limitation inherent in the study design was that students participated in the focus groups after completing the survey. As such, they had already been exposed to an overview of feedback strategies, making it more likely that they would refer to these. The interviewers tried to address this limitation by asking students to explain their responses, including by reflecting on specific examples.

Further research using additional measures is needed to investigate perceived and actual helpfulness of feedback (Van der Kleij and Lipnevich, 2021). For example, studies could use observational data and link self-reported perceptions of feedback helpfulness to actual use of feedback as demonstrated in different work samples. Additionally, this field of research would be informed by studies that differentiate perceived helpfulness of feedback for learners at different proficiency levels.

4.2 Implications for feedback practice in schools

Our findings have important implications for classroom practice and teacher PL and provide valuable insights into how teachers may facilitate active student engagement with feedback. Student-centred feedback processes, including the co-construction of success criteria and peer feedback, helped students to understand what success looked like and showed them how to improve, causing them to perceive feedback as more helpful than prior to the

intervention. Teachers would be well advised to draw upon these active learning strategies to develop students' in-depth understandings of quality work and self-regulated learning (Brooks et al., 2021a). These findings also call into question the benefit to students of traditional, transmissive models of feedback that exist in schools. Acknowledging this, school leaders should be considerate of PL opportunities to build teacher capability in using these student-centred feedback strategies in the classroom, so that students perceive feedback as helpful whilst not placing unnecessarily high burdens on teachers.

The above discussion has already highlighted the importance of the interrelatedness of certain feedback strategies. We would like to stress that although the feedback strategies perceived as more helpful by students following the intervention fell under feeding up and feeding forward, the process of feeding back to check in on progress is inextricably related (Hattie and Timperley, 2007). It is only when students are actively involved in each phase of the feedback cycle that the potential of feedback can be fully realised.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to their containing information that could compromise the privacy of research participants.

Ethics statement

The studies involving humans were approved by University of Queensland and Queensland Department of Education. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

CB: Formal analysis, Writing – original draft, Writing – review & editing, Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Resources, Supervision. RB: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing, Project administration. FK: Formal analysis, Writing – original draft, Writing – review & editing. CA: Formal analysis, Validation, Writing – original draft, Writing – review & editing. AC: Conceptualization, Funding acquisition, Methodology, Writing – review & editing. JH: Conceptualization, Methodology, Writing – review & editing. JS: Data curation, Writing – original draft, Writing – review & editing.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2024.1433184/full#supplementary-material>

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Basic psychological needs satisfaction as a mediator of the effects of a formative assessment practice on behavioral engagement and autonomous motivation

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Formative assessment has been suggested as a means of supporting student motivation. However, empirical studies have shown mixed effects of formative assessment interventions on students' motivation, making it necessary to understand the mechanisms underlying these effects. We analyzed a formative classroom practice implemented by a 10th-grade first-language teacher during 7 months. Teacher logs, classroom observations and a teacher interview were used to collect data for characterizing the formative assessment practice. Changes in students' satisfaction regarding the basic psychological needs of perceived autonomy, competence and relatedness, as well as changes in student motivation manifesting as engagement in learning activities and autonomous types of motivation, were measured by pre- and post-questionnaires in the intervention class and four comparison classes. Since the intraclass correlation values ICC(1) and ICC(2) were low, we treated the comparison classes as one group and t-tests were used in the significance testing of the differences in changes in psychological needs satisfaction and motivation between the intervention class and the comparison classes. Path analysis was conducted to investigate whether a possible influence of the intervention on autonomous motivation and behavioral engagement would be mediated by basic psychological needs satisfaction. The analysis of the classroom practice in the intervention class identifies that both teacher and students were proactive agents in formative assessment processes. The analysis of the quantitative data shows that students' psychological needs satisfaction increased more in the intervention class than in the comparison classes, and that this needs satisfaction mediated an effect on students' behavioral engagement and autonomous motivation.

KEYWORDS

formative assessment, assessment for learning, motivation, basic psychological needs, behavioral engagement

1 Introduction

Motivation is the driving force of human behavior and a prerequisite for student learning. It is therefore paramount to find ways to effectively promote students' motivation, and formative assessment is a classroom practice that has been suggested to improve motivation (e.g., Clark, 2012). Some empirical evidence for positive effects from formative assessment on student motivation have been found, but the effects have varied substantially. To understand why some formative assessment practices have certain effects on motivation while others do not, it is necessary to understand the mechanisms underlying the effects and how they function for different characteristics of formative assessment practices.

One way formative assessment may affect students' motivation is by enhancing students' satisfaction with the three psychological needs of competence, autonomy and relatedness (e.g., Hondrich et al., 2018; Leenknecht et al., 2021; Pat-El et al., 2012). However, few studies have empirically investigated the three psychological needs as mediators of effects of formative assessment on students' motivation. In particular, studies within an ecologically valid regular classroom environment are scarce (Hondrich et al., 2018). Furthermore, there is a lack of studies investigating the three psychological needs as mediators for the effects on motivations manifested both as behavioral engagement and type of motivation, and for the mediating role of a composite measure of the satisfaction of all three needs. Studies using a composite measure could provide further valuable insight into the role of students' psychological needs satisfaction since, according to self-determination theory (Ryan and Deci, 2020), all three needs are important for students to be autonomously motivated.

In this study, we describe and analyze a formative assessment practice involving a 10th-grade first-language teacher and her students. This practice was carried out as a daily classroom practice for 7 months. We investigate changes in the students' psychological needs satisfaction, measuring both all three needs individually and a composite of all three needs. We then compare these students' changes with changes in four comparison classes. We also investigate whether the composite measure mediates an influence of the formative assessment practice on students' behavioral engagement and autonomous motivation.

2 Literature review

2.1 Motivation

Given the critical role that motivation plays in student learning, it is important to find ways to effectively promote students' motivation. Students' motivation to learn may be manifested in their *engagement* in learning activities, that is the extent to which they are actively involved in learning activities (Skinner et al., 2009). Engagement is a multidimensional construct comprising four distinct yet interrelated aspects. *Behavioral engagement* pertains to the extent of the student's involvement in learning activities, reflecting their on-task attention and effort. *Emotional engagement* refers to the presence of positive emotions, such as enjoyment, during learning activities. *Agentic engagement* involves the student's intentional, proactive, and constructive contributions to the teaching and learning activities, such as offering suggestions or expressing preferences. Finally, *cognitive*

engagement relates to the student's strategic approach to learning, involving the use of advanced learning techniques (Matos et al., 2018). Studies on engagement may include all or only individual aspects. In the latter case, naturally, the results cannot consider the relationships between the aspects. However, a focus on individual aspects may sometimes be necessary, and many studies do so. In the present study, to keep the student questionnaires sufficiently short, and also include measures of different types of motivation, we will focus on one individual aspect of engagement. The chosen aspect is behavioral engagement. This choice is based on that research has consistently reported higher levels of student behavioral engagement to be associated with higher levels of achievement (Fredricks et al., 2004; Hospel et al., 2016) and other forms of engagement (e.g., emotional and cognitive) to be weaker predictors of achievement than behavioral engagement (Stefansson et al., 2016).

While engagement refers to a manifestation of motivation in terms of what the students do, how much they do it, and with what intensity they do it, students may also have different types of motivation; that is, they may be motivated for different reasons. Self-determination theory (Ryan and Deci, 2020) describes such different types of motivation. Students will be *intrinsically motivated* to engage in activities that they experience as inherently interesting or fun and that allow them to feel competent and autonomous. *Extrinsic motivation*, in contrast, does not require the activities to be of interest to the students; rather, this type of motivation refers to engaging in activities as a means to an end: students choose to engage in activities because they believe they will lead to positive outcomes or prevent negative outcomes. Extrinsic motivation differs in the extent to which the reasons for students' actions are self-determined or autonomous. Students may engage in activities because of external rewards, to avoid discomfort or punishment, to avoid feeling guilty or to attain ego-enhancement or pride. Such motivation reflects external control and is termed *controlled motivation*. Students may also have a more autonomous form of extrinsic motivation, engaging in an activity because they personally find it valuable and have identified its regulation as their own. Both this latter form of extrinsic motivation and intrinsic motivation are termed *autonomous types of motivation*. A student's motivation type has consequences for learning and well-being. Autonomous types of motivation have been shown to be associated with not only greater engagement but also higher quality learning and greater psychological well-being. Controlled motivation, in contrast, has been shown to be associated with negative emotions and a poorer ability to cope with failures (Ryan and Deci, 2020).

Thus, positive student outcomes can be expected from facilitating students' motivation in terms of engagement in learning activities and autonomous types of motivation. However, successfully supporting such motivation is not easy. Studies have shown that student engagement often decreases and student motivation becomes less autonomous throughout the school years (Ryan and Deci, 2020; Wylie and Hodgen, 2012).

2.2 Formative assessment

Formative assessment is a classroom practice that has been suggested as a possible way to support student motivation (e.g., Clark, 2012). However, as argued by Yan and Chiu (2022), only formative assessment with certain characteristics and implemented to a sufficient

extent is likely to have a significant effect on students' motivation. In addition, implementing high-quality formative assessment is associated with challenges and barriers to overcome (e.g., Heitink et al., 2016; Yan et al., 2021). Formative assessment can be defined as follows:

Practice in a classroom is formative to the extent that evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers, to make decisions about the next steps in instruction that are likely to be better, or better founded, than the decisions they would have taken in the absence of the evidence that was elicited (Black and Wiliam, 2009, p. 9).

Thus, formative assessment is a teaching and learning practice. Such classroom practices may differ, but they are unified by the common core characteristics of teachers and/or students gathering information about the students' learning and adapting teaching and/or learning to meet the identified learning needs. For example, the definition above (Black and Wiliam, 2009, p. 9) affords approaches to formative assessment with a focus on the teachers gathering evidence of student learning through classroom dialogue or short written tests and adapting feedback or subsequent learning activities to the students' knowledge, skills and learning needs identified in these assessments. In two other approaches to formative assessment, students may play a more proactive role in the core formative assessment processes. The students may support each other's learning through peer-assessment and subsequent peer-feedback, where the latter involves providing explanations and suggestions to peers on how they can act to reach their learning goals. Students may also be proactive agents in formative assessment processes as self-regulated learners who assess their own learning and take subsequent action to meet the identified learning needs. When conducting a formative assessment practice in which the students are proactive agents in the core formative assessment processes, the teacher's role is to help the students become motivated and proficient in carrying out these processes. Formative assessment practices may also include a combination of all the above-mentioned approaches.

2.3 Formative assessment as a means of supporting student motivation

A few empirical studies have found positive relationships between formative assessment and grade 1–12 students' behavioral engagement. In a cross-sectional study, Federici et al. (2016) found a positive association between students' perception of their teachers' formative assessment practice and aspects of behavioral engagement; moreover, intervention studies by Näsström et al. (2021), Palmberg et al. (2024) and Wong (2017) all found that formative assessment had a positive effect on students' behavioral engagement. Relationships between formative assessment with grade 1–12 students and the students' autonomous motivation have also been empirically investigated. Cross-sectional studies have found positive relationships between formative assessment and students' autonomous types of motivation (e.g., Baas et al., 2020; Federici et al., 2016; Pat-El et al., 2012). However, findings from intervention studies on the effect of formative assessment practices on students' autonomous motivation range from no effect to a moderate effect (e.g., Förster and Souvignier,

2014; Hondrich et al., 2018; Meusen-Beekman et al., 2016; Näsström et al., 2021; Palmberg et al., 2024).

2.4 Mechanisms underlying the effects of formative assessment on student motivation

To understand why some formative assessment practices have certain effects on motivation while others do not, it is necessary to understand the mechanisms underlying the effects and how they function for different characteristics of formative assessment practices. One way formative assessment may affect students' motivation is by enhancing students' satisfaction with the three psychological needs of competence, autonomy and relatedness. According to self-determination theory (Ryan and Deci, 2020) these psychological needs influence students' autonomous types of motivation. According to the self-system model of motivational development, fulfilment of these psychological needs may also influence students' engagement (Skinner et al., 2008). Moreover, it is hypothesized that an increase in autonomous motivation leads to greater student engagement (Ryan and Deci, 2020). Formative assessment may facilitate needs satisfaction in several ways. Teacher feedback helping students monitor their learning progress and providing support for how goals and criteria can be met may make the students' learning progress more explicit, and recognizing learning gains would foster feelings of competence (Andrade and Brookhart, 2020; Hondrich et al., 2018). Teacher feedback focusing on students' effort, task-solving processes and learning progress may also influence students' sense of autonomy (Andrade and Brookhart, 2020). Heritage and Wylie (2018) emphasize the inclusion of students in these processes of assessment and feedback. They argue that supporting students as peer-assisted and self-regulated learners by arranging for information from self-assessment and peer-assessment to affect classroom practices would enhance students' sense of both autonomy and relatedness.

Although the numbers of studies investigating the effects of formative assessment on psychological needs vary between these needs, positive associations and effects have been found for all three needs—that is, the need for a sense of competence (Granberg et al., 2021; Hondrich et al., 2018; Pat-El et al., 2012; Rakoczy et al., 2019; Wollenschläger et al., 2016), a sense of autonomy (Granberg et al., 2021; Pat-El et al., 2012) and a sense of relatedness (Pat-El et al., 2012). However, very few studies have empirically investigated the three psychological needs as mediators of effects of formative assessment on students' behavioral engagement or type of motivation. In a cross-sectional questionnaire study, Pat-El et al. (2012) found that students' perceived competence and relatedness mediated an association between formative assessment and autonomous motivation, while perceived autonomy did not. Hondrich et al. (2018) found an indirect effect of formative assessment on autonomous motivation via perceived competence (sense of autonomy and relatedness were not included in the study). Kiemer et al. (2015) investigated students' perceptions of their teachers' support of their psychological needs, rather than of the actual fulfilment of these needs. They found that students' perceived support of both autonomy and competence mediated the association between formative assessment and students' autonomous motivation. All three of these studies focused on formative assessment in the form of teachers' tasks or questions and

their feedback or adapted instruction, and not on practices in which students play a more proactive role in the core formative assessment processes as peer- or self-assessors. In addition, none of these studies included an investigation of how formative assessment affected students' engagement. Furthermore, although some studies investigating research questions other than those in the present study have used a composite measure of the satisfaction of the three psychological needs (e.g., [Haerens et al., 2019](#)), to the best of our knowledge none have investigated the potentially mediating role of a composite measure of the satisfaction of the three basic psychological needs in the effects of formative assessment on either student engagement or autonomous motivation.

In summary, formative assessment has been proposed as a way of enhancing student motivation, but studies that have investigated the effects of formative assessment on motivation within an ecologically valid, regular classroom environment are scarce ([Hondrich et al., 2018](#)). In addition, existing studies show a substantial variation in the effects. However, studies empirically investigating mechanisms underlying the effects are few, in particular, very few studies investigate the three psychological needs as mediators of the effects of formative assessment on behavioral engagement and type of motivation. In addition, we did not find any studies investigating such mediating effects from practices in which both the teacher and the students are proactive agents in the core formative assessment processes. Furthermore, there is a similar lack of studies investigating the mediating role of a composite measure of needs satisfaction.

In the present study we aim to contribute to filling the above-mentioned gaps in the literature by investigating the mediating effects of the three psychological needs on student motivation in an ecologically valid formative assessment practice that can be characterized as including both teacher and students being proactive agents in the formative assessment practices. In the investigation we will use a composite measure of the needs satisfaction. To be able to design FA practices with the largest effects on motivation we need to understand why some formative assessment practices have certain effects on motivation while others do not. It is necessary to understand the mechanisms underlying the effects and how they function for different characteristics of formative assessment practices. Investigating the mediating effects of the psychological needs in practices where both teachers and students are proactive agents in the formative assessment practices is important since such practices have the potential to provide more ways of influencing student motivation than the practices in which only the teacher is the main proactive agent ([Palmberg et al., 2024](#)). Using a composite measure of the needs satisfaction in this investigation could complement previous insights about the role of students' psychological needs satisfaction since, according to self-determination theory ([Ryan and Deci, 2020](#)), all three needs are important for students to be autonomously motivated and existing studies have all used measurements of each individual need satisfaction.

3 Research questions

In this study, we describe and analyze a classroom practice involving a 10th-grade first-language teacher (referred to using the pseudonym Jenny) and her students. Jenny aimed at engaging each and every student in formative assessment activities, and the practice

was carried out during 7 months. We investigate changes in the students' psychological needs satisfaction, measuring both all three needs individually and a composite of all three needs. We then compare these students' changes with changes in four comparison classes. We also investigate whether the composite measure mediates an influence of the formative assessment practice on students' behavioral engagement and autonomous motivation. We ask the following research questions:

1. What are the characteristics of Jenny's formative assessment practice?
2. Does satisfaction of the three psychological needs increase in students in the intervention class, and how do changes in psychological needs satisfaction in the intervention class compare with changes in the comparison classes?
3. Does students' basic psychological needs satisfaction mediate an influence of the formative assessment practice on their behavioral engagement and autonomous motivation?

Research questions 2 and 3 are the main research questions in the study, but for the results to these research questions to be meaningful it is essential to identify the characteristics of the implemented formative assessment practice (Research question 1).

4 Methods

4.1 Procedure

Jenny had participated in a professional development programme (PDP) in formative assessment the previous year, and this year she aimed at implementing some of the activities she had learned from the PDP. Data used for the characterization of Jenny's formative assessment practice was collected through teacher logs, classroom observations and a teacher interview. The students' basic psychological needs satisfaction, behavioral engagement and autonomous motivation were measured using a questionnaire in all five classes at the beginning and end of the intervention (fall and spring). The intervention class and comparison classes were compared in terms of changes in the students' responses to the questionnaire items before and after the intervention, and mediation was studied through path analysis. We were not given the opportunity to follow and analyze the practices of the teachers in the comparison classes. However, Jenny was asked not to implement any new formative assessment activities during the first 2 months of the term in order not to influence the students' responses to the first questionnaire. This means that the first questionnaire can be seen as a baseline measurement that we used to compare the effects of the teaching in the comparison classes and Jenny's teaching before she had implemented her formative assessment practice. Taking this baseline measurement into account, the second questionnaire was then used to compare the effects of Jenny's implemented formative assessment activities with the effects of the teaching in the comparison classes, reducing effects from variables pertaining to the intervention teacher's personal characteristics. The study design is a comparison between a changed practice and business-as-usual practices.

4.2 Participants

One intervention class taught by Jenny and four comparison classes at the same upper secondary school in Sweden participated in the present study. Jenny, who had a few years of teaching experience and had participated in a professional development program (PDP) in formative assessment the previous year, started to teach a Swedish language course for a class enrolled in the technology program and aimed to implement a formative assessment practice. The four comparison classes took the same Swedish language course, but their teachers had not participated in the PDP and continued to teach the same way they had done in previous school years. All students were approximately 17 years old, came from different social and cultural backgrounds, and were enrolled in academic programs that do not differ much regarding students' prior academic achievement. Twenty students in the intervention class and 72 students in the comparison classes agreed to participate and completed both questionnaires. The distribution of students in the different classes is reported in [Table 1](#).

4.3 Characterizing the formative assessment practice

Three sources of data; teacher logs, observations and an interview were used for triangulation to ensure the validity and reliability of the description of the classroom practice.

4.3.1 Data collection

4.3.1.1 Teacher logs

To obtain data about the enactment of, intentions with and experiences from the formative assessment implementation, Jenny was asked to make log notes shortly after having a lesson or a series of lessons. The log notes were made in a web-based form, where the teacher provided descriptions of implemented activities, reasons for choosing the activities, evaluations of the implementations, descriptions of what had worked out well and what had not worked out, and further comments. Jenny wrote 14 logs during the 7-month period. She also spontaneously wrote five emails commenting on the logs. Since the comments sometimes clarified the logs, the emails were compiled into the log text.

4.3.1.2 Classroom observations and teacher interview

The observations and interview were used to collect further examples and details about the implemented classroom practice. The framework by [Wiliam and Thompson \(2008\)](#) that operationalizes the definition of formative assessment by [Black and](#)

[Wiliam \(2009\)](#) was used in the data analysis. Both the observation scheme and the interview guide were structured in accordance with the key strategies in the framework. These key strategies are: (KS 1) working with students to achieve a common interpretation of the learning goals; (KS 2) eliciting evidence of student learning; (KS 3) providing feedback that moves learners forward; (KS 4) activating students as instructional resources for one another (peer-assessment and peer-feedback); and (KS 5) activating students as the owners of their own learning (self-assessment and subsequent adjustment of learning).

Data was collected from six classroom observations (60–80 min). In addition to focusing on the five key strategies, the observation scheme included support questions such as: 'How are the learning goals presented?', 'How is information about student learning gathered, and how is the information used?'; and 'How can students identify their progress?'. Indications of how commonly the activities were used in the classroom were noted—for example, if the students reacted with surprise or if the material seemed to have been used before. The researcher took notes throughout the observation. If Jenny informally spoke to the researcher before, during or after the observation, that information was included in the field notes.

The interview conducted at the end of the intervention was 80 min long. It was audio-recorded and transcribed. During the interview, information from the teacher log and classroom observations was used to initiate or boost the conversation. Aside from asking for examples and details about the implemented classroom practice, the interview included questions about Jenny's reasons for using those implemented activities. The interview guide can be found in the [Appendix](#).

4.3.2 Data analysis

To identify and describe the characteristics of the formative assessment practice used by Jenny, an analysis of the collected data was conducted in three steps. First, we identified activities that align with any of the five key strategies in the formative assessment framework by [Wiliam and Thompson \(2008\)](#) described above. Activities not including any characteristics of formative assessment were excluded from the next step of the analysis. In the second step, we also excluded activities that were not regularly used by the teacher; for example, activities were excluded if Jenny expressed or indicated that the activity was new or had only been tested a few times, or if data from the observations indicated that the activity was not commonly used (unused material, uncertain or surprised students, etc.). As a last step, we listed and rigorously described the identified regularly used activities using all available data (logs, observations, and interview) as the basis to characterize Jenny's formative assessment practice. The

TABLE 1 Number of students in the intervention class and comparison classes.

Class	Program	Students	Girls
Intervention class	Technology program	20	8
Comparison class 1	Economy program	23	13
Comparison class 2	Natural science program	23	14
Comparison class 3	Technology program	15	5
Comparison class 4	Technology program	11	3

four activities that most characterize Jenny's practice are presented in the results section. The analysis was generally carried out by the first author, but with the assistance of the other authors at times of uncertainty.

4.4 Measures of basic psychological needs satisfaction, autonomous motivation, and behavioral engagement

4.4.1 Data collection

Research questions two and three examine the possible effect of the intervention on changes in students' basic psychological needs satisfaction and whether changes in needs satisfaction mediate a possible influence of formative assessment on students' changes in behavioral engagement and autonomous motivation. Therefore, measures of the changes in each of these constructs were obtained by inviting students to answer a questionnaire before and after the intervention. The questionnaire comprised 27 items. All items measuring behavioral engagement and basic psychological needs satisfaction were statements the students could respond to on a scale from 1 (not at all) to 7 (fully agree). The items measuring students' autonomous motivation were statements of reasons for working during lessons or for learning the course content. The students were asked to mark the extent to which these reasons were important on a scale from 1 (not at all a reason) to 7 (really important reason).

Five items measuring behavioral engagement were adaptations of items from Skinner et al.'s (2009) questionnaire items on behavioral engagement. Items measuring needs satisfaction of autonomy (four items), competence (four items) and relatedness (six items) were also adapted from previously used questionnaire items (Deci et al., 2001; Ilardi et al., 1993; Kasser et al., 1992). Eight items measuring autonomous motivation were adapted from Ryan and Connell's (1989) Self-Regulation Questionnaire. The adaptations were made to suit the context of the participants, for example by changing from a work context to the school context. Before the study, these adaptations were piloted with students in four other classes of the same age group to ensure that the questions were easy to understand. The questionnaire used in this study, and subsets of it, have been used in several other studies (Granberg et al., 2021; Näsström et al., 2021; Hofverberg et al., 2022; Palmberg et al., 2024). A list of all questionnaire items can be found in the Appendix. An example of an item measuring behavioral engagement is: 'I am always focused on what I'm supposed to do during lessons'. Example items, respectively, measuring need satisfaction of autonomy, competence and relatedness are: 'I feel that, if I want to, I have the opportunity to influence what we do during lessons'; 'I am sure I have the ability to understand the content in this subject'; and 'My classmates care about me'. An example of an item measuring autonomous motivation is: 'When I work during lessons with the tasks I have been assigned, I do it because I want to learn new things'. Cronbach's alpha for each set of the items in spring/fall was 0.89/0.86 for behavioral engagement, 0.85/0.84 for need satisfaction of autonomy, 0.82/0.87 for need satisfaction of competence, 0.94/0.89 for need satisfaction of relatedness and 0.87/0.87 for autonomous motivation, indicating good internal consistency of the scales. To assess unidimensionality of each scale, we conducted exploratory factor analysis on each set of items for each time point. We used principal axis factor as extraction method, and for each scale, at each

time point, parallel analysis suggested that only one factor should be retained, indicating that answers to the items are influenced by the same latent factor. We chose not to do exploratory factor analysis on all items for each time point because the low subject to item ratio (<5:1) would make the risk of misclassifying items and not finding the correct factor structure high (Costello and Osborne, 2019). The mean of the items connected to each construct (students' behavioral engagement; need satisfaction of autonomy, competence, and relatedness; and autonomous motivation) at each time point was used as a representation of that construct at the time point. The composite measure of students' basic psychological needs satisfaction (BPNS) was calculated by adding the averages of each basic need satisfaction for each time point. Cronbach's alpha for this measure – calculated for all items measuring the three different psychological needs – was 0.86 and 0.81, respectively, for before and after the intervention.

4.4.2 Data analysis

To investigate the intervention class students' changes in needs satisfaction of autonomy, competence and relatedness, independently or as a composite measure (RQ2), means and mean differences in the responses to the questionnaire items pertaining to these constructs between fall and spring were calculated for students in the intervention class and those in the comparison classes. To assess whether the intervention class changed their basic psychological needs satisfaction, for each need and as a composite measure, paired sample *t*-tests were made and Hedges' *g* (Hedges, 1981) was calculated to get an indication of the size of the difference. Comparisons between the intervention class and comparison classes (as one group) were performed through independent samples *t*-tests. For the need satisfaction of relatedness, Welch's *t*-test was used, since homogeneity of variances could not be assumed. For each comparison, Hedges' *g* was again calculated as an indication of the size of the difference. Although the students were nested within classes, we treated the comparison classes as one group after having examined two types of intraclass correlations in accordance with Bliese (2000). Lam et al. (2015) suggests that multilevel analysis is warranted if ICC(1) exceeds 0.1 and if ICC(2) exceeds 0.7. In the comparison classes, ICC(1) < 0.03, and ICC(2) < 0.34 for all measures. The low ICC(1) means that between-class variation is very small and does not contribute much to the total variation of scores, and the low ICC(2) indicates a low degree of reliability with which class-mean ratings differ between classes.

To investigate whether a possible influence of the intervention on autonomous motivation and behavioral engagement is mediated by basic psychological needs satisfaction (RQ3), we conducted path analysis with Mplus 8.4 on two models. The models were specified with relationships between changes in basic psychological needs satisfaction, autonomous motivation and behavioral engagement, as proposed by Ryan and Deci (2020) and Skinner et al. (2008) (see Section 1.4). First, we used a saturated model in which the intervention was specified to predict changes in the composite measure of basic psychological needs satisfaction (BPNS), students' autonomous motivation and behavioral engagement, where changes in BPNS predict changes in students' autonomous motivation and behavioral engagement, and where changes in autonomous motivation predict behavioral engagement. Then, we compared the first model with a more parsimonious model in which BPNS fully mediated the influence of the intervention. All analyses were run using the maximum likelihood estimator and bootstrapping for standard errors.

Although the students were nested, the ICC(1) and ICC(2) values for the outcome measures (i.e., autonomous motivation and behavioral engagement) for the whole sample were very low ($ICC(1) < 0.012$, and $ICC(2) < 0.17$), indicating that multilevel analysis would be ill advised (e.g., Marsh et al., 2012). Change scores and the composite measure of basic psychological needs satisfaction were used in order to keep the ratio between parameters and sample size as low as possible for the path analysis.

5 Results

5.1 Description of the characteristics of the formative assessment (RQ1)

One overall characteristic of Jenny's formative assessment practice was the embeddedness of the activities – that is, the formative assessment activities were interwoven with each other and with other aspects of her teaching. Another characteristic was her way of providing the students with opportunities and support to become active agents in the core formative assessment processes by facilitating their motivation and proficiency in carrying out these processes. Below, we present four salient formative assessment activities that characterized and permeated Jenny's classroom practice: (1) warmups, (2) 'the thumb', (3) study groups and (4) teacher feedback. Because Jenny used formative assessment with embeddedness, the activities can often be linked to more than one key strategy.

Jenny used the *warmup* activity at the beginning of a course module to achieve a mutual understanding of the learning goals and the progress criteria for having attained these goals (key strategy 1). In the warmup activity, Jenny first presented the learning goal (e.g., the knowledge and skills being aimed for, regarding a particular type of text) and then activated the students to collaborate and discuss the main aspects of and progress criteria for this goal. An example of a warmup comes from students' work with the investigative text type. Jenny provided examples of ready-made texts for the students; the students then worked together in groups to assess the texts using a grading matrix and provided feedback on the texts. The feedback from all groups was discussed among the whole class with the aim of achieving a mutual understanding of what constitutes a high-quality investigative text type. During the rest of the course module, Jenny used the learning goals and progress criteria on a daily basis as a point of reference in her feedback (key strategy 3).

Jenny used *'the thumb'* as a way of eliciting information about students' learning (key strategy 2) and the relevance of the learning activities, in order to adjust the teaching and learning in the classroom when needed. But, although Jenny could get a hint of the students' learning, the activity foremost aimed at supporting students in taking a proactive role in the formative assessment processes (key strategy 5). 'The thumb' meant that the students—in the whole class or in groups—responded to Jenny's questions by pointing their thumbs up (positive), down (negative) or horizontally (as an in-between response). For example, in the data, Jenny asked questions such as: 'How did the work go for you?', 'How did you use the time?' and 'What thumb would you like to give this activity?'; and then asked selected students to give the reason for their (thumb) response. 'The thumb' activity provided an opportunity for the students to reflect on their learning process and gave Jenny information about, for instance,

students' perceptions of the learning goals and their learning in relation to those goals. For example, between two seminars involving writing about language change (see below), Jenny asked the students about their experiences of the first seminar; together, they concluded that it had only worked for some groups. She then let the groups themselves identify their individual needs and the most helpful way of structuring the second seminar.

The *study group* activity eventually became an activity Jenny used in most course modules. The main purpose of the activity was to make the students take responsibility for their own learning, albeit with structured support from their peers (key strategy 4 and 5). The students were activated in formative assessment processes as self-regulated learners and through peer-assessment with subsequent peer-feedback. The study group activity was a more complex and long-lasting form of organizational activity than the warmup and 'thumb' activities. It included a structure of planned sub-activities that followed one another for several weeks, including: doing a joint exercise before working with individual assignments; sharing work in progress and giving each other feedback within the group; and evaluating the general learning progress of the group. These evaluations included feedback to the group or to Jenny, which was used to determine how to proceed.

In the study groups, the students could have individual assignments but supported each other in carrying out these assignments. Jenny supported the students by explicitly describing the purpose of the (sub-)activities and what the students' roles were (e.g., assessors and feedback providers to themselves and peers). Furthermore, she modelled these roles, provided opportunities to practice the roles, and then reflected on the activities together with the students. She provided frames for the work that gave students possible choices within those frames. For example, in the course module 'Language change in Sweden and the Nordic countries', Jenny organized the groups and presented the learning goal, the most important progress criteria of the learning goal and the sub-activities (key strategy 1). The students could choose which genre of a text they wanted to use and how to present their work to the rest of the class. The students could consult Jenny while making their decisions, but Jenny encouraged the students to turn to each other in the study group. At the start of any study group activity, Jenny talked about the purpose of the activity and emphasized that the study group is there for students to raise issues, discuss and reflect together. To help the students successfully support each other, Jenny discussed and provided opportunities for practice on how to give helpful feedback. Another type of peer-feedback support was access to templates formulating the progress criteria for different types of texts. As the weeks went by, Jenny reminded the students of the purpose of the study group activity, the learning goals and the progress criteria, as well as how to provide helpful goal-related peer-feedback.

Jenny did provide *feedback* on subject-matter content, but her feedback focus was on helping students to become proactive agents in the formative assessment processes (key strategies 3, 4 and 5). As exemplified above, she planned for activities in which students self-assessed, peer-assessed and gave each other peer-feedback; she then observed her students carrying out these activities and provided feedback focused on these specific processes and on the students' collaborative learning processes in general. The feedback she gave to students asking for her help was mostly focused on supporting them to be proactive agents in the formative assessment processes. This feedback was provided with the aim of making the students assess their own learning progress and reflect on the goal of the continued work and the reasons why they

got stuck. Based on this assessment, she often asked the students to suggest their own strategies for making progress with the assignment. To assist their thinking, she encouraged the students to ask themselves questions and think aloud to find ways to move on. Sometimes she helped the students to take the first step and get started, such as by referring the students to previously successful methods or materials.

5.2 Changes in students' basic psychological needs satisfaction (RQ2)

The satisfaction of all three individual basic psychological needs, and therefore also the composite measure of basic psychological needs satisfaction (BPNS), increased in the intervention class, although the increase for relatedness was small (see Table 2). The point estimate for the size of the change in the intervention class was large for autonomy [$t(19) = 4.960$, $p < 0.001$; $g = 1.07$], medium for competence [$t(19) = 2.438$, $p = 0.025$; $g = 0.52$], close to zero for relatedness [$t(19) = 0.161$, $p = 0.87$; $g = 0.04$], and large for the composite measure [$t(19) = 4.117$, $p < 0.001$; $g = 0.88$].

Comparing the changes in the intervention class with the changes in the comparison group, t -tests reveal that the intervention

class has a statistically significant better development than the comparison group regarding satisfaction of the need for autonomy [$t(90) = 3.688$, $p < 0.001$], relatedness [$t(76.248) = 2.086$, $p = 0.040$] and BPNS [$t(90) = 3.126$, $p = 0.002$], but not for satisfaction of the need for competence [$t(90) = 1.166$, $p = 0.247$]. Effect size estimates indicate that the differences are large for the need satisfaction of autonomy ($g = 0.92$) and BPNS ($g = 0.78$). For the needs satisfaction of relatedness and competence, Hedges' g is 0.34 and 0.30, respectively.

5.3 Needs satisfactions' mediation of the influence of the formative assessment practice on students' engagement and autonomous motivation (RQ3)

Zero-order correlations for the constructs used in the path analysis (Table 3) reveal significant relationships between all variables except between the intervention and autonomous motivation and between the intervention and behavioral engagement. Table 4 displays means and standard deviations for autonomous motivation and behavioral engagement.

TABLE 2 Mean scores and standard deviations (in parentheses) for students' basic psychological needs satisfaction.

Variable	Intervention class (N = 20)			Comparison group (N = 72)		
	Pre	Post	Change	Pre	Post	Change
Autonomy	4.53 (0.94)	5.51 (0.84)	0.99 (0.89)	4.41 (1.25)	4.44 (1.25)	0.03 (1.06)
Competence	5.55 (1.04)	6.00 (0.79)	0.45 (0.83)	5.78 (0.98)	5.97 (0.86)	0.18 (0.92)
Relatedness	6.36 (0.60)	6.37 (0.67)	0.02 (0.42)	5.95 (1.04)	5.65 (1.39)	-0.30 (1.00)
BPNS	16.43 (2.15)	17.89 (1.61)	1.45 (1.58)	16.14 (2.15)	16.05 (2.35)	-0.09 (2.03)

TABLE 3 Correlations between measures used in the path analysis.

Variable	1	2	3	4
1. Intervention	1			
2. BPNS	0.313**	1		
3. Autonomous motivation	0.129	0.363**	1	
4. Behavioral engagement	0.104	0.439**	0.332**	1

Significance levels: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

TABLE 4 Mean scores and standard deviations (in parentheses) for students' behavioral engagement and autonomous motivation.

Variable	Intervention class (N = 20)			Comparison group (N = 72)			Total sample (N = 92)		
	Pre	Post	Change	Pre	Post	Change	Pre	Post	Change
Behavioral engagement	4.88 (0.83)	4.95 (1.20)	0.07 (0.96)	4.53 (1.16)	4.36 (1.15)	-0.17 (0.92)	4.61 (1.10)	4.49 (1.18)	-0.12 (0.92)
Autonomous motivation	4.49 (0.99)	4.66 (1.03)	0.18 (1.25)	4.44 (1.18)	4.31 (1.15)	-0.13 (0.87)	4.45 (1.13)	4.39 (1.13)	-0.06 (0.97)

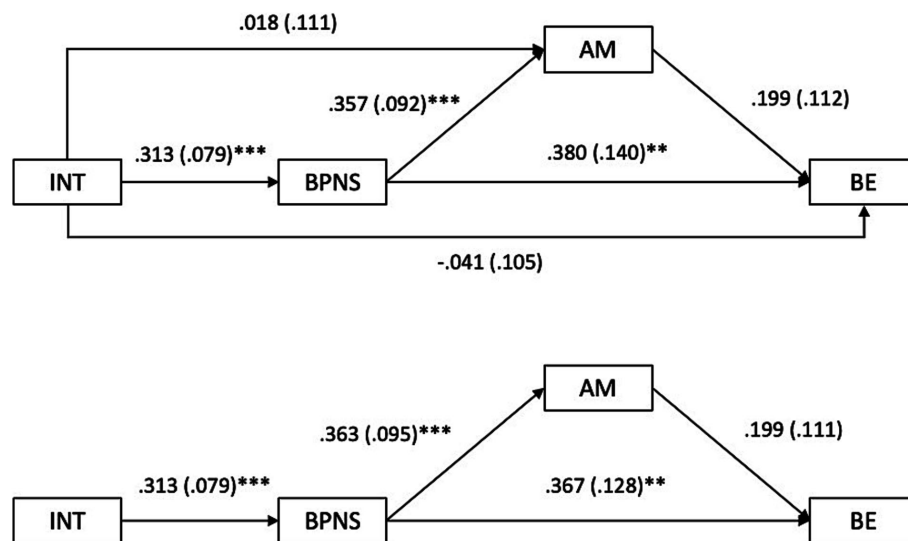


FIGURE 1

Path diagrams for the saturated model (top) and parsimonious model (bottom) with estimated relationships between the manifest variables. INT represents whether students belong to the intervention group (1) or not (0); BPNS is basic psychological needs satisfaction; AM is autonomous motivation; and BE is behavioral engagement. Path coefficients are standardized with SE in parenthesis, and asterisks indicate significance level as follows: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

The results of the path analyses are depicted in Figure 1, with standardized path coefficients, standard error and significance level of coefficients for a saturated model and for a more parsimonious model in which the influence of the intervention on autonomous motivation and behavioral engagement is fully mediated by the composite measure of basic psychological needs satisfaction (BPNS). The more parsimonious model has excellent fit (Hu and Bentler, 1999; Steiger, 2007) [$\chi^2(2, 92) = 0.211, p = 0.900$; CFI = 1.00; RMSEA = 0.00; SRMR = 0.011] and, in the saturated model, the paths representing direct effects on autonomous motivation and behavioral engagement from the intervention have very small and nonsignificant path coefficients. This finding implies that any possible influence of the intervention is fully mediated by BPNS. Tests of indirect effects in the parsimonious model show that there is in fact a statistically significant indirect effect on behavioral engagement from the intervention through BPNS ($\beta = 0.115, SE = 0.044, p = 0.009$) but not via autonomous motivation ($\beta = 0.023, SE = 0.014, p = 0.115$). Furthermore, there is a similarly sized indirect effect on autonomous motivation from the intervention via BPNS ($\beta = 0.114, SE = 0.047, p = 0.015$). The hypothesized relations between basic psychological needs satisfaction and autonomous motivation and behavioral engagement are both significant and in the expected direction, whereas the relation between autonomous motivation and behavioral engagement is in the expected direction but not significant ($p = 0.074$).

6 Discussion

6.1 Research question 1 characteristics of the implemented formative assessment practice

We began the results section by describing the characteristics of Jenny's formative assessment practice as a means of making sense of the results of the study's two main research questions (RQ2, RQ3). We conclude that Jenny's practice includes activities where she acts as

the main proactive agent in the core formative assessment processes (identifying students' learning needs and providing feedback and learning activities adapted to these needs) as well as activities where she provides her students with opportunities and support to become proactive agents in the core formative assessment processes (peer-assessment with peer-feedback, and self-assessment with subsequent actions to meet identified learning needs). We will use this conclusion and the identified characteristics in the discussion below.

6.2 Research question 2 changes in students' psychological needs satisfaction

The results concerning Research question 2 show that, in comparison with the comparison classes, psychological needs satisfaction increased in the intervention class in which the formative assessment practice was implemented, and the increase was statistically significant for all needs constructs except perceived competence. In addition, the increase was large for both perceived autonomy and the composite measure of all three needs. This increase in perceived autonomy compared with the comparison group is larger than the association between perceived autonomy and the formative assessment practice focusing on teacher feedback reported by Pat-El et al. (2012), but smaller than the reported increase from the practice described by Granberg et al. (2021) in which both the teacher and the students to a larger extent than in the present study were proactive agents in the formative assessment processes. The increase in students' perceived relatedness compared with the comparison group is smaller than that of perceived autonomy, but the same size as the association between perceived relatedness and the formative assessment practice reported in Pat-El et al. (2012). The increase in perceived competence in this study is the same size as the increase in perceived competence accomplished by the formative assessments investigated by Hondrich et al. (2018) and Rakoczy et al. (2019), but smaller than the increase in perceived competence from the formative assessment studied by

Wollenschläger et al. (2016). These three studies focused on formative assessment focused on the teacher as the proactive agent. The increase in perceived competence in the present study was much smaller than the increase from the practice described by Granberg et al. (2021) in which both teacher and students to a very large extent were proactive agents in the formative assessment processes. Thus, the results of this study complement the existing literature by showing that this type of formative assessment may produce similar effects on students' satisfaction of their three individual psychological needs—and even larger effects on students' perceived autonomy—than the formative assessment practices focusing on the teacher as proactive agent in the formative assessment processes reported in the literature. However, the results also indicate that classroom practices that to an even larger extent include both the teacher and the students as proactive agents in the formative assessment practices, such as the one described in Granberg et al. (2021), may accomplish even larger effects. The large increase in students' perceived autonomy in the intervention class may be understood through the many ways Jenny showed interest and trust in the students' ideas and capability to take responsibility, as well as the many opportunities students were provided to make choices within given frames. That teacher activities with such characteristics would enhance students' sense of autonomy is described within self-determination theory and have been empirically shown in several studies (Ryan and Deci, 2000; Ryan and Deci, 2020). The potential impact of these activities may also explain why this practice had a larger effect on students' sense of autonomy than the practice focusing mostly on teacher feedback described by Pat-El et al. (2012), and less effect than the practice described by Granberg et al. (2021). The former practice did not include many of these types of activities while the latter included even more activities with these characteristics than Jenny's practice.

Perceived competence may have been facilitated by the support Jenny gave the students in understanding the goals and progress criteria as well as in assessing and giving feedback to themselves and each other in order to recognize their learning and how to take the next learning step. Several researchers (e.g., Andrade and Brookhart, 2020; Hondrich et al., 2018) have argued that understanding a goal and having the experience that one can reach it can enhance a sense of competence, and this is also posited by self-determination theory (Ryan and Deci, 2020; Ryan and Deci, 2000). However, it is possible that the students' perceived competence would have been further facilitated by complementing the students' feedback with more frequent feedback from the teacher to clarify the learning the students had accomplished. Teacher feedback may sometimes be experienced as more trustworthy if coming from the teacher (Bader et al., 2024).

The students' perceived relatedness decreased in the comparison classes, while remaining very high in the intervention class. This lack of decrease in the intervention class may have been due to all the collective discussions and group work incorporated in the classroom practice. Indeed, Heritage and Wylie (2018) argued that supporting students as peer-assisted and self-regulated learners by arranging for information from self-assessment and peer-assessment to affect classroom practices would enhance students' sense of relatedness. However, Jenny's practice did not increase the students' perceptions of relatedness when comparing their responses to the questionnaire at the two timepoints. This may have been due to their very high perceptions of relatedness already at the time of the first questionnaire when many students had already

responded with the highest possible response. However, although Jenny aimed to foster a classroom climate in which students helped each other, student–student interactions do not always accomplish mutual trust and feelings of care. Implementing a more comprehensive system to ensure that these interactions actually foster a sense of belonging and connection may have been necessary for greater enhancement of perceived relatedness. This could have entailed a larger focus on helping students to provide peer feedback with comments experienced as given out of care. Self-determination theory stresses that feeling respected and cared for is a central tenet of relatedness (Ryan and Deci, 2020; Ryan and Deci, 2000). It is also possible that a longer period of time would have been required for students to fully experience the benefits of peer feedback, as well as to develop trust in and appreciation for this type of feedback, which could have led to increased perceived relatedness.

6.3 Research question 3 psychological needs as a mediator of effects of formative assessment

Our third research question concerns the mechanisms underlying the effects of formative assessment on autonomous motivation and student engagement by focusing on psychological needs satisfaction as a mediator of these effects. The existing studies on the mediating effects on autonomous motivation—all of which involve the teacher as the proactive agent in the formative assessment processes—show mixed results for the individual needs satisfaction of perceived autonomy, competence and relatedness as mediators of the effects of formative assessment on autonomous motivation (Hondrich et al., 2018; Kiemer et al., 2015; Pat-El et al., 2012). The present study complements this research in two ways, by (1) providing empirical evidence that a *composite construct* of the satisfaction of all three psychological needs may mediate an increase in autonomous motivation from formative assessment; and (2) doing so by involving a practice that also includes students as proactive agents in the formative assessment processes. Moreover, this study shows that basic needs satisfaction can also mediate the effects of formative assessment on *students' engagement* in learning activities, which to the best of our knowledge has not been previously empirically investigated. Thus, the results indicate that this type of formative assessment practice has the potential to enhance both students' autonomous motivation and their engagement in learning activities by facilitating their satisfaction of the psychological needs of autonomy, competence and relatedness.

The effects on psychological needs satisfaction from the kinds of activities included in the implemented formative assessment practice fits well with self-determination theory, and the subsequent mediating effects on autonomous motivation and engagement is aligned with self-determination theory (Ryan and Deci, 2020; Ryan and Deci, 2000) and self-system model of motivational development (Skinner et al., 2008) respectively. Self-determination theory also hypothesizes that an increase in autonomous motivation leads to greater engagement (Ryan and Deci, 2020). We therefore expected to find a relation between autonomous motivation and engagement. The estimate for this relation was in the anticipated direction, but not statistically

significant. We would not argue that this necessarily implies that there is no real relation between autonomous motivation and behavioral engagement. Another possibility is that the relatively small number of students in the intervention group limits the possibilities to detect weaker relationships (see Section 6.5).

6.4 Implications for practice

The results of the study imply that formative assessment may be used to enhance student motivation, and that practices in which both the teacher and the students are proactive agents in the formative assessment processes could accomplish larger effects on motivation than practices in which only the teacher acts as the proactive agent. The results also imply that it could be beneficial to design the activities so to facilitate students' satisfaction of the three psychological needs of autonomy, competence and relatedness. Such activities would include supporting students in understanding the learning goals and criteria for progress, providing feedback that recognizes the students' learning progress, and supporting the students' motivation and ability to autonomously and proactively assess their own and their peers' learning and provide supportive peer- and self-feedback.

However, developing such practices is not an easy endeavor. These practices place great demands on the teacher because it both requires students to take a more active role than they are used to and requires the teacher to replace well-known activities with activities they may not feel comfortable and competent doing. Implementing formative assessment that enhances student motivation also seems to require making more well-grounded decisions than traditional teaching (Näsström et al., 2021), and although involving students as proactive agents in the formative assessment processes has the potential to provide more ways of influencing student motivation than practices in which only the teacher is the main proactive agent (Palmberg et al., 2024) those practices require additional decision-making and teaching competencies to carry out effectively. Thus, to successfully develop such formative assessment practices it is likely that teachers would need substantial professional development support. But, implementing such practices has been found to be difficult even with professional development support (e.g., Heitink et al., 2016; Yan et al., 2021), and in particular with large-scale professional development initiatives (Anders et al., 2022). However, several studies have identified characteristics of teacher professional development programs that are important for teachers to be able to develop formative assessment practices (e.g., Andersson and Palm, 2018; Boström and Palm, 2020), and examples of professional development support that has accomplished formative assessment implementation with positive effects on student motivation do exist (e.g., Näsström et al., 2021; Palmberg et al., 2024).

6.5 Limitations and future studies

A limitation of the study is the rather small sample consisting of 20 students in one intervention class and 72 students in four comparison classes. Thus, generalizations of the results of this study to other contexts must for several reasons be made with caution. The rather small, and unbalanced, sample also make the study

underpowered to detect smaller effects. Also, the inclusion of only one intervention class does not allow for a variation in contextual factors (such as other teacher characteristics, school factors, and national policies) and in a variation in the characteristics of classroom practices grounded in the same formative assessment principles. Furthermore, the use of only one intervention class introduces the risk of bias connected to the teacher's role. The teacher's personal characteristics rather than the formative assessment practice might influence the results. However, administering the first questionnaire after 2 months of regular teaching in both the intervention class and the comparison classes creates a measurement of the effects of the teachers' regular teaching in their respective student groups. Thus, when comparing the students' responses to the questionnaire at time point 2 with their responses at time point 1 the only difference in teaching is the implemented formative assessment in the intervention class. Possible effects on students' motivation pertaining to the intervention teacher's personal characteristics and relationships with her students would likely be similar at both time points.

Another limitation is that we did not analyze the classroom practices in the comparison classes. If some of the teachers in the comparison classes also would have developed formative assessment practices in significant ways, this could have influenced the results. However, teachers need extensive professional development support to implement formative assessment (Heitink et al., 2016), and since the teachers in the comparison classes had not received that kind of support it is unlikely that they would have developed such practices. Furthermore, if they had implemented some formative assessment practices similar to that made by the intervention teacher, differences in formative assessment practices would have been smaller. In that case, logically, the effects of formative assessment we found would be underestimates rather than overestimates of the actual effects of the intervention teacher's formative assessment practice in comparison with non-formative assessment practices. Finally, we chose to use a composite measure for the students' psychological needs satisfaction. This complements existing studies that all have used measurements of each individual needs satisfaction when investigating psychological needs satisfaction as mediators of the effects of formative assessment on motivation. None of these measures would be better per se, they provide different kinds of valuable information. According to self-determination theory (Ryan and Deci, 2020) all three needs are important for the type of motivation students will develop, so effects on motivation may, for example, sometimes occur when there is an increase in all individual needs satisfaction although none of them are large. Using a composite measure might detect such effects, while using individual measure might not. On the other hand, a limitation of using a composite measure is that it might obscure variation in the influence of the satisfaction of individual needs. Future studies using larger samples of intervention teachers and involving more thorough analyses of the classroom practices in the comparison groups would be valuable for making more generalizable conclusions about the effects of formative assessment on students' psychological needs satisfaction and about psychological needs satisfaction as a mediator of the effects of formative assessment on students' motivation type and

engagement in learning activities. In such larger studies, there would be a greater chance to identify smaller but still meaningful effects, and it would also be possible to compare the mediating effects of each individual psychological need construct and a composite construct involving all three psychological needs, which could provide further insights into the mechanisms underlying the effects of formative assessment on different manifestations of motivation.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Written informed consent was not obtained from the minor(s)' legal guardian/next of kin, for the publication of any potentially identifiable images or data included in this article because all students in the study were older than 15 years. In Sweden, for students of that age legal guardians informed consent is not necessary. The written consent of the students is sufficient.

Author contributions

CA: Conceptualization, Formal analysis, Investigation, Methodology, Validation, Writing – original draft, Writing – review & editing. CG: Conceptualization, Investigation, Methodology, Validation, Writing – original draft, Writing – review & editing. BP: Conceptualization, Formal analysis, Investigation, Methodology, Validation, Writing – original draft, Writing – review & editing. TP: Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Validation, Writing – original draft, Writing – review & editing.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2025.1523124/full#supplementary-material>

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Same assignment—two different feedback contexts: lower secondary students' experiences with feedback during a three draft writing process

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This study explores students' conceptions and experiences with feedback as integrated parts of a three draft writing process and group discussions in English as a foreign language (EFL) in three schools. The students ($n = 106$, six classes) were following the same draft writing process design during a full school day. The same assignment was given to all participating students, but different feedback contexts were assigned in each school. Half of the students received AI-generated feedback (context 1), while the remaining received peer feedback (context 2). Observations were conducted in all classes during the writing assignment. Individual interviews with students ($n = 22$) were used to investigate students' experiences during the draft writing process, and the interviews were thematically analyzed. We find that while AI-generated feedback information supported students dialogic feedback interactions the peer feedback context allowed for students to rehearse their assessment and feedback strategies. The study also reveals that peer feedback for lower secondary school students is challenging, since the students function as both feedback givers, receivers and users during the draft writing process. Key aspects regarding how the students engaged with AI-generated feedback and peer feedback are discussed and we find that both feedback contexts have the potential to develop feedback literacy among lower secondary school students. Our study can contribute to the growing understanding of the relationship between feedback contexts, lower secondary students' uptake of feedback, and how feedback literacy could be developed.

KEYWORDS

formative feedback, automated feedback, AI-feedback, peer feedback, feedback literacy, writing process

Introduction

In this study we explore lower secondary students' conceptions and experiences with formative feedback during a three draft writing process. Both AI-driven and peer assessment contexts are examined. We investigate student conceptions of feedback, how they engage with feedback, and whether they act upon feedback they receive, seek and engage with. In our study a writing task was designed specifically to involve students actively in feedback loops during the writing process. By examining how students experience integrated formative feedback loops, we wanted to explore their roles not just as receivers of feedback but also their roles as active participants (e.g., assessors and discussion participants) in the writing process. The study leverages a design-based approach, incorporating student voices through interviews and a thematic analysis to contribute to the understanding of how feedback influences students' learning experiences and development of feedback literacy (Andrade et al., 2021; Sutton, 2012).

Hattie and Timperley (2007) suggest it is useful to consider a continuum of instruction and feedback and emphasize that feedback has no effect in a vacuum, and that its power must be related to the learning context in which feedback is addressed. This notion elucidates feedback processes as situated practices. Feedback has a powerful influence on student learning and achievement (Hattie and Timperley, 2007; Lipnevich and Panadero, 2021), and assessment for learning and formative feedback are found to be particularly effective in promoting learning (Black and Wiliam, 2009). Formative and summative feedback is often perceived as dichotomous, and mutually exclusive. However, summative assessment can enhance student learning if the embedded information is used formatively (Black et al., 2011; Gamlem et al., 2024). Assessment and feedback are formative when progress is elicited, interpreted and used to inform decisions about further steps likely to improve the learning process and hence also further progress (Sadler, 1989; William and Leahy, 2007). Formative feedback could be understood as information provided from various sources (e.g., from teachers, peers, or technology), and in addition to stemming from diverse sources feedback could also have different modes. Within assessment for learning feedback should be embedded in learning trajectories and take advantage of the critical moments where assessment makes learning change direction (moments of contingencies) (Black and Wiliam, 1998a, 2009). However, classroom feedback practices have historically resisted change due to a focus on one-way information delivery to learners and students (Boud and Molloy, 2013). Such a one-way transmission model of feedback information is by Gamlem and Smith (2013), van der Kleij et al. (2019) argued for as questionable since it assumes a passive student role and thereby overlooks the importance of issues related to how feedback is received, interpreted and made use of by the learner. Feedback practices to enhance learning should therefore involve deliberate and purposeful transformations in classroom practices, content wise but also regarding learning processes, roles and relationships (Andrade et al., 2021). Dialogic feedback interactions might help students construct a path forward but is seldom employed in the classroom setting (Gamlem and Smith, 2013). Interactive dialogues between the teacher and the students or among the students can thus be seen as powerful for students' learning.

Feedback engagement and participation

Askew and Lodge (2000) uses the metaphors *feedback as a gift* and *feedback as collaborative work*. By doing so they emphasize the difference between being a passive recipient of feedback information (feedback as a gift) and the active two- or multiple way-involvement and engagement in feedback (feedback as collaborative work). When feedback is used in a formative process, students often become more active and engaged in regulating their learning (Andrade, 2010; Brandmo et al., 2020), and involving teachers and students in feedback loops, individually and collectively, is perceived to increase the quality of learning (Black and Wiliam, 1998b; Hattie and Timperley, 2007; Pedder and James, 2012). The importance of being an active participant in feedback processes is associated with the basic assumptions in self-regulated learning; That learners (ideally) gradually develop cognitive and affective strategies, empowering them to monitor and lead their own learning process (Andrade, 2010; Andrade et al., 2021). Emphasis on the active role of the learner is also reflected in an ongoing conceptual shift from analyzing feedback as external input (from a feedback giver) to analyzing the mechanisms involved in how feedback is received (within the feedback receiver) (Lui and Andrade, 2022).

The active feedback recipient role is by Carless and Boud (2018) elucidated as they describe feedback as «[a] process through which learners make sense of information from various sources and use it to enhance their work or learning strategies [...] Information may come from different sources e.g., peers, teachers, friends, family members or automated computer-based systems to support student self-evaluation of progress» (Carless and Boud, 2018, p. 1315–1316). According to Carless and Boud (2018) a well-developed feedback literacy is a precondition for such a sense-making process to occur. Sutton (2012, p. 33) was the first to introduce the concept of feedback literacy and defined the concept in the following way:

“[...] a set of generic practices, skills and attributes which, like information literacy [...] is a series of situated learning practices. Becoming feedback literate is part of the process that enables learners to reach the standards of disciplinary knowledge indicated in module and program learning outcomes [...] that assists learners in forming judgments concerning what counts as valid knowledge within particular disciplines; and that helps them develop the ability to assess the quality of their own and others work.”

In Sutton (2012) further conceptualization of feedback literacy, three dimensions are identified and unpacked: (1) The epistemological dimension (feedback on and for knowing), (2) the ontological dimension (developing educational being through feedback) and (3) the practical dimension (acting upon feedback). According to Sutton (2012) feedback literacy requires much more than students' understanding and accepting why they have received a certain grade, and his distinction between feedback on- and for- knowing could be perceived parallel with the distinction between summative and formative assessment and feedback within the assessment for learning-domain. Whilst feedback on knowing (FoK) on one hand has potential to boost learners' confidence in what they already know and do, it also tends to constitute learner identity as more or less successful. Feedback for knowing (FfK), on the other hand, is formative in character and indicate an openness to the “possibility of movement and development” (Sutton, 2012,

p. 34). But engaging with FfK seems to be more challenging than FoK since it can require students to “change their mode of knowing the world and themselves” (Sutton, 2012, p. 35). In other words, developing FfK will require the learner to understand their own potential for development and growth. Developing educational being through feedback is therefore the second dimension of feedback literacy conceptualization as proposed by Sutton (2012). The main point made is that feedback literacy development will change the relationship of learners to themselves and their educational world, implying that their confidence could both increase and decrease along the way. The third and final dimension unpacked by Sutton (2012) is the practical dimension: The ability to act upon, or feed forward, the feedback given and received. It is argued that learners cannot be assumed to possess skills needed to act on feedback. Therefore, explicit guidance concerning how to act and feed forward may be needed to various degrees. Sutton (2009, 2012) also highlight the need to address and overcome language barriers which could influence learners’ capacity to understand, interpret and act upon feedback. The third dimension thereby underline the necessity of learning to decode feedback information.

Carless and Boud (2018) have later expanded on Sutton (2012) dimensions, and they propose a set of four inter-related features, which could constitute a framework underpinning feedback literacy of students. These are: (1) appreciating feedback processes, (2) making judgments, (3) managing affect and (4) taking action (acting). The framework further supposes that maximizing the mutual interplay of first three features will maximize the potential for students to act on feedback provided. It should be noted that the framework describing feedback literacy has been developed in higher education and most research regarding feedback literacy have been conducted in higher educational contexts. For this reason, we use this framework as a starting point to investigate feedback literacy in other contexts (e.g., lower secondary school). However, in regard of our study, it should also be mentioned that feedback literacy might influence a student’s engagement and effectiveness in using feedback to improve writing. Graham (2018) emphasizes the potential to build writing confidence for the student, by providing feedback on techniques and language to develop their writing. Helping students develop self-generated feedback by providing concrete strategies for monitoring progress is crucial for fostering feedback literacy, as it creates opportunities for internal and external feedback to converge when the writer engages in text review (Fiskerstrand and Gamlem, 2023).

Peer assessment and peer feedback

Peer assessment is alongside self-assessment by many advocated as a central part of formative assessment and assessment for learning practices, and peer feedback has been recognized as a meaningful approach to enhance student engagement (Andrade et al., 2021; Panadero, 2016). According to Gielen et al. (2010) peer assessment is an assessment form performed by equal status learners, which does not contribute to final grades. This type of feedback has a qualitative output aim, where strengths and weaknesses of a specific task- or activity performance (and recommendations for further improvement) are discussed. Peer assessment could be perceived as a learning tool for developing students’ judgment and ability to recognize quality work, and

according to Nicol (2021) feedback designs could benefit from turning natural comparisons (that students are making anyway) into formal and explicit comparisons potential for learners. Gielen et al. (2010, p. 144) argue that students “peer assessment skills can be trained so that their feedback becomes as effective as teacher feedback in the end.” Gielen et al. (2010) found that peer feedback can substitute teacher feedback without a considerable loss of effectiveness in the long run. However, despite being optimistic around the use of peer assessment in classroom practices, studies investigating the efficiency and usefulness of peer feedback vary in their findings. While some studies have suggested that peer feedback can be as effective as traditional teacher feedback, the findings are not consistent. For instance, Double et al. (2020) concluded that there are positive effects of peer assessment compared to teacher assessment. But the study also pointed out that when grading is incorporated in peer feedback on students’ learning it is only beneficial for tertiary students but not primary or secondary school students. Cho and Schunn (2007) reported no significant difference in student performance between single peer feedback and teacher feedback, suggesting that peer assessment may be equally valid in certain contexts. However, Yang et al. (2006) found that teacher feedback led to greater performance improvements, indicating that the effectiveness of feedback methods may vary depending on the nature of the task and the students involved. It is also important to recognize the challenges associated with peer feedback (Panadero et al., 2023).

Peer assessment activates several motivational, cognitive and emotional processes with a potential to enhance the learning of the assessor and the assessee, and it thereby involves multiple social and human factors, since peer assessment does not happen in a vacuum (Panadero, 2016; Panadero et al., 2023). Peer assessment produces thoughts, actions, and emotions as part of the feedback interactions, and according to Panadero (2016) the traditional focus on the accuracy and reliability of peer assessment information has been too extensive and he thereby encourage a shift of focus to what happens during feedback interactions. Panadero (2016) further argues that peer assessment could not be perceived a specific concept, ready to be implemented in teaching and learning, but rather as a variety of practices, involving both human and social capacities. Gamlem and Smith (2013) highlighted that peer feedback can sometimes be perceived as damaging due to disrespectful behaviors exhibited by peers during the feedback process. These findings are in line with the complex relationships between students’ inner processes and the relation between participants during peer assessment processes, which according to Panadero (2016) entail both intra-individual factors and interpersonal aspects in addition to cognitive aspects. In their recent systematic review Panadero et al. (2023) elaborate on the characteristics of intrapersonal factors (variables within the learner) and interpersonal factors (relationships between learners) in peer assessment. Intrapersonal factors include motivation to perform, and emotions experienced as feedback is expected to increase learning and self-regulation strategies (e.g., Double et al., 2020). Interpersonal factors on the other hand include the relationships between the assessor and the assessee and the level of trust and psychological safety between participants during an assessment process (Panadero et al., 2023). The findings reveal poor reporting of peer assessment intervention characteristics and concluding remarks call for an increased focus on formative implementations

to produce better intrapersonal and interpersonal results (Panadero et al., 2023).

Peer assessment is itself a complex activity, since it activates several inter- and intrapersonal factors and processes. In addition, another layer of complexity is added, since the individual learner often must shift between roles during the feedback process. The different role characteristics as assessor and an assessee have different psychological and interpersonal consequences and activates different emotions and strategies (Panadero, 2016; Panadero et al., 2023). However, little research has distinguished between- and explored the contrasts between these two roles (Panadero, 2016). Despite adding another layer on complexity, an important argument for the use of peer assessment is that it enhances both learning and performance in two distinct ways: The assessee receives direct feedback on how to improve and the assessor become more aware of their own strengths and weaknesses (Panadero, 2016). Peer assessment therefore enhance self-assessment capability, and students self-regulated learning where peers act as co-regulators of assessee peers. Peer assessment is an opportunity to learn more, and most students have positive attitudes toward peer assessment and often report to have learning gains (Panadero, 2016).

Technology enhanced assessment and feedback

Over the recent decades, numerous forms of digital feedback systems have emerged in the educational field, and technology-enhanced assessment (TEA) and technology-enhanced feedback (TEF) has become growing areas of development and research (Munshi and Deneen, 2018). In accordance with general assessment research, early development and studies focused on the efficiency and accuracy of automated scoring systems (associated with summative assessment). But as the field of assessment shifted focus toward formative feedback and assessment for learning, the growing awareness of what constitutes quality feedback revealed limitations regarding how technology could support and enhance assessment and feedback processes (Munshi and Deneen, 2018). Still, the last two decades of rapid technology development has brought far more sophisticated technologies, as technologies have emerged and converged. Digital technologies now enable communication through multiple combinations of modality (e.g., text, images, and sound), and the internet infrastructure have enabled such multi modal information and communication to overcome previous limitations regarding the co-location and synchronic participation in feedback processes. The development of more sophisticated algorithms has also enabled personalized, individualized, and timely feedback to customize and facilitate student activity while continuous feedback is offered.

Munshi and Deneen (2018, p. 341) identified three distinct processes that could enhance feedback during feedback provision across different feedback technologies. These are: “(1) *acquiring* information from the student during some learning activity, (2) *transforming* the acquired information into a feedback message, and (3) *conveying* the feedback message to the student.” In their analysis they found that four out of ten TEF-systems in the literature enhanced feedback by acquiring information, transforming information, and conveying information, and these

four systems were: e-learning applications, automated marking systems, intelligent tutoring systems (such as AI-generated feedback) and computer games. Huang et al. (2023) did a similar review focusing on how technology could assist the feedback process, and they found that technology could support (1) *generating* feedback, (2) *delivering* feedback and (3) *using* feedback. However, in their concluding remarks both Munshi and Deneen (2018), Huang et al. (2023) point at important blind spots: Research on student uptake of technology-based feedback and the characteristics of quality feedback in technology remains limited. This is concerning since many educational- and feedback technologies claim to contribute to bolster and enhance metacognition and self-regulated learning (e.g., Knight and Buckingham Shum, 2017; Pardo et al., 2017).

Despite challenges to provide formative feedback in educational settings, utilization of automated- and artificial intelligence (AI) technologies in assessment practices has been perceived an important contribution to increase reliability and reduce human bias and the risk of making mistakes (Chen et al., 2020). The functionalities of automated feedback- and scoring systems (including artificial intelligence technologies) are expected to serve as means to improve assessment practices as it speeds up marking time, reduces or removes human bias and increase the accuracy and reliability of assessment (Richardson and Clesham, 2021). Automated feedback- and scoring systems are already applied in various educational contexts across educational levels but are mostly studied in computer science- and online courses in higher education. When studied, automated- and AI applications are found to perform assessment at a high accuracy and efficiency level as long as large and relevant datasets are available for training the systems (machine learning) (Zawacki-Richter et al., 2019). In addition, automated- and AI technologies have the potential to increase reliability and validity of assessment and could thus assist both student learning trajectories and teachers' overall assessment practices (Chen et al., 2020). But debates regarding the role of automated- and intelligent feedback systems in formal education still fuel a fear of machines taking over the role of humans as nuanced examiners (Baker, 2016; Richardson and Clesham, 2021). Issues related to the role of judgment in assessment and feedback practices thereby also seem to influence an emerging field of research aiming to reduce the risk of bias and human mistakes in assessment practices. This clearly demonstrates that ongoing debates about the importance of summative accuracy vs. the quality of formal feedback live side by side also in research revolving technology assisted assessment and feedback. According to Liu et al. (2016) it is necessary to evaluate the applicability of traditional learning theories in contexts infused with computer technology. Strengths associated with educational use of tablets and computers are also related to shifts of roles in the classroom, frequent transitions, and the facilitation of varied activities including collaboration and discussion. This is in line with previous mentioned debates regarding the importance of active participation in both formal and informal feedback processes during a learning process.

AI-generated feedback have been found to offer diverse benefits in language learning, primarily through personalized and efficient responses. According to Barrot (2023), Engeness and Mørch (2016), AI tools adapt feedback to each student's needs, providing targeted support that addresses specific areas of improvement. These systems also process large volumes of writing quickly, making

them scalable for educational settings (Giannakos et al., 2024). Additionally, AI tools can support formative assessment, offering immediate feedback that fosters self-directed learning and helps students independently address their errors (Shadiev and Feng, 2023). However, AI-generated feedback has certain limitations. For example, it may struggle with understanding the context and nuances of student writing, leading to generic or misaligned responses (Barrot, 2023). There is also a risk of students becoming overly reliant on AI corrections, potentially weakening their self-editing and critical thinking skills (Giannakos et al., 2024). While effective for surface-level errors, AI feedback may not address more complex aspects of writing, like creativity and argumentation (Hopfenbeck et al., 2023). Furthermore, ethical concerns, including data privacy, need careful consideration (Giannakos et al., 2024). In summary, while AI-driven feedback is valuable for its personalized, immediate support, it should be balanced with traditional teaching methods to address its limitations and maximize its educational impact.

Design, aim and research question

While previous research has offered useful and detailed conceptualizations of feedback, more knowledge is needed on how students perceive and engage with diverse types of feedback, particularly in the complex context of digital learning environments. This study specifically investigates lower secondary students' conceptions and experiences with feedback information from an AI-driven feedback system and peer assessment within a pre-planned and structured writing process. To do so, we interviewed students in how they engage with feedback information to improve their own text (three paragraph essay) throughout a three draft writing process. The group of participating classes were split in two, and two different feedback contexts were investigated. The design of the writing trajectory was the same in both contexts, but in one context the students received feedback information from an AI-driven computer-based system, and in the other the students received peer feedback. While existing research acknowledges the importance of feedback literacy (Andrade et al., 2021; Sutton, 2012), our study contributes to the emerging knowledge of issues regarding feedback literacy development in lower secondary school contexts. By employing two different feedback information sources we can describe some similarities and differences regarding how the participating students act on feedback according to their assigned context.

The aim of this study is to explore lower secondary students' experiences with feedback as integrated parts of their three draft writing process and group discussions. By exploring the student's experiences with AI-generated feedback (context 1) and peer assessment and feedback (context 2) our study contributes with nuanced and situational knowledge regarding how students perceive feedback in two different contexts. Understanding how students view and experience both peer feedback and automated feedback during a writing process is essential for identifying strategies that might enhance their learning experiences and foster engagement in an increasingly digital and collaborative educational environment. In addition, we explore and discuss similarities and differences between receiving automated AI-driven feedback (context 1) and peer-feedback (context 2). We take a closer look

at students' uptake of feedback, dialogic feedback interactions and feed forward actions in response to the feedback (Carless and Boud, 2018) in the two contexts. The following research question (RQ) drive the study: *How did lower secondary students from two feedback contexts (peer feedback and AI-generated feedback) experience the process of receiving-, discussing- and acting on feedback during a three draft writing process?*

Methodology

This project is a design-based research (DBR) study (Brown, 1992; The Design-Based Research Collective, 2003). The requirement to develop practical design principles through iterations of testing and development is considered a key strength of DBR (Anderson and Shattuck, 2012). However, design-based research should not merely focus on enhancing classroom practices and learning processes in real life-context. It should also address theoretical questions and issues (Collins et al., 2004). In the present study, we employ data procured from the initial development phase (first iteration) of the AI-driven technology Essay Assessment Technology (EAT). EAT is specifically designed to facilitate assessment and feedback for learning during students writing processes and is programmed to provide feedback based on predetermined sets of criteria. The EAT system acquires information from learners texts and generates, transforms and delivers feedback to the students in a one-step process. It offers various functionalities, the most relevant to the present study being its focus on writing mechanics, such as spelling, punctuation, missing commas, and capitalization errors. Instead of providing the correct answers, the feedback highlights that the text requires improvement and suggests how revisions should be made. This feedback signals to students that a specific word or sentence has an issue needing attention. In this way, the EAT distinguishes itself from many other AI tools, such as Grammarly or Word. These tools predominantly suggest changes to the text, requiring users to either accept or reject the modifications. In contrast, the EAT moves beyond static corrections by offering developmental feedback designed to encourage reflection and learning about the reasoning behind the errors. This approach promotes a deeper understanding of the writing process.

The experiences of the students, as captured through interviews conducted immediately following their writing and feedback interactions, were subjected to rigorous coding and thematic analysis. Consequently, this research adopts a qualitative interview study methodology. Considering that the researchers have been actively involved in the design of the learning and feedback trajectories, in addition to observing the writing process throughout the data collection day(s), they possess an in-depth understanding of the context to which the students refer. This facet of the research enhances its ecological validity (Gehrke, 2018).

Sample and participants

The sample in this study consists of students from six classes at three different schools in a municipality in Eastern Norway. The students were lower secondary students in the eighth grade (12–13 years old). As visually represented in Table 1 below, a

TABLE 1 Overview of the participants, participating schools, context 1, context 2 and days of data collection.

Participating schools	Participating classes	No of participating students	No of interviewed students	Data collection
School A	Context 1 (AI-generated feedback)	20	3	One school day
	Context 2 (peer feedback)	24	3	
School B	Context 1 (AI-generated feedback)	21	4	One school day
	Context 2 (peer feedback)	11	5	
School C	Context 1 (AI-generated feedback)	15	4	One school day
	Context 2 (peer feedback)	15	3	
Total		106	22	

total of 106 students participated. One class from each school were using AI-technology (context 1) where the students received feedback on their written work from the AI-driven EAT software. Simultaneously, another class from the same school used peer assessment (context 2). Peer feedback was grounded in same predetermined assessment criteria that EAT utilize in its automated feedback. This ensured consistency in the study design.

The project was approved by the Norwegian Agency for Shared Services in Education and Research (SIKT) and informed consent was provided by all participating students and their legal guardians.

The learning trajectory: assignment and feedback contexts

In the current study we focus on a three draft writing process. The lower secondary students completed a writing task over the course of one school day, starting in the morning in their own classrooms. The participating students were part of their normal classes which made the classroom environment similar to their everyday learning context. To ensure comparable consistency a group of three researchers from the research team was present

alongside the teacher in all classes (at all three schools), to observe during the students’ writing process. The physical classroom setup was pre-arranged in the same way for context one (AI-generated feedback) and context two (peer feedback) and across all three schools. The students were placed in groups (4–5 students) by their teachers and the students’ desks were grouped beforehand by the teachers so the students would not have to spend time forming groups when discussing the feedback provided. The task assignment was printed for all students and was handed out during the introduction to the task itself and the assigned feedback context trajectory (Table 2). The time allocated for each activity during the writing process was pre-planned by the team of researchers in collaboration with the teachers. The wording of the assignment was as follows: “Write a story about someone you consider to be a hero. It can be a fictional or a real person doing something heroic. The length of your essay should be approximately 400 words.”

The feedback loops

All students across the two contexts had 40 min to write their first drafts. Students from context 1 wrote their texts in

TABLE 2 Overview of the three draft writing trajectories.

Assignment	Write a story about someone you consider to be a hero. It can be a fictional or a real person doing something heroic. The length of your essay should be approximately 400 words.	
Context	Context 1: AI-generated feedback	Context 2: Peer feedback
Writing process and feedback design	Introduction to the assignment	Introduction to the assignment
	AI-driven automated feedback software	Assessment rubric
	Write first draft	Write first draft
	AI-feedback and group discussion (round 1)	Peer-feedback and group discussion (round 1)
	Write second draft	Write second draft
	AI-feedback and group discussion (round 2)	Peer-feedback and group discussion (round 2)
	Write third/final draft	Write third/final draft
	Submit final draft	Submit final draft
Feedback focused on	Language (spelling, grammar, and punctuation)	Language (spelling, grammar, and punctuation)

the EAT text editor while students from context 2 wrote their texts in Microsoft Word. As the first step of the feedback loop, the students from context 1 pressed the feedback button in EAT, which immediately submitted their drafts to the automated feedback process (driven by AI). The software technology in turn generated and delivered feedback on students' language (spelling, punctuation, grammar). The automated feedback loop was followed by a 10 min review where students were expected to select three feedback points from EAT to address in the following group discussion. Students from context 1 then participated in a 20 min group discussion, before revising their drafts for 40 min and submitted a second version for a second feedback loop. The corresponding first step of the feedback loop students assigned to context 2 reviewed a peer's draft for about 15 min by using an assessment rubric. The rubric was developed and printed by the researchers and handed out by the teachers. The rubric was designed to ensure that the feedback would address the same language categories as EAT (thus focusing on spelling, punctuation, and grammar). The students in the peer feedback context were then expected to provide feedback to their assigned peer before they engaged in a group discussion to support the revision process of their peer's work for about 15 min. Like the students in context one the students further revisited their drafts for another 40 min before a second feedback loop. Feedback information could be given in English or Norwegian to ensure clarity and reduce language barriers. Both groups from each school completed two feedback loops, producing a third draft for final submission. The entire three draft writing process spanned 180 min, and the students submitted their final draft to a Microsoft Teams folder created by the class teacher. Throughout the process, teachers were available in all classes to address questions, and they were otherwise expected to assist and facilitate the process like they would normally have done. The full writing process and integrated feedback loops are summarized in [Table 2](#).

Data collection

During the day of the three draft writing process the project group of researchers collected data (students' essays, recorded video for observation, student- and teacher interviews etc.) from both feedback contexts. Of the 106 participants, 22 students (11 from each context) were interviewed by the researchers who had been present in their classroom during the day. All student interviews were conducted according to a semi-structured interview guide, developed by the team of researchers. The questions in the interview guide were designed to initiate a conversation about students' experiences with receiving, giving and engaging with feedback during the draft writing process, but also at school in general. However, the interviewing researchers also asked follow-up questions if they wanted the students to elaborate on aspects initiated by the students or if they felt the need to rephrase one or more question(s). The student interviews could therefore be described as semi-structured interviews (e.g., [Kvale and Brinkmann, 2009](#)). The student interviews were conducted in the end of the day, after finishing the writing process, this to

ensure consistency in the context and environment in which the data were collected. This approach minimizes variations that may arise from differing circumstances, thereby enhancing the reliability of the findings. Conducting the interviews at the end of the process allows for a more coherent comparison of responses. This ensures that the experiences discussed remain fresh in the students' memories providing a clearer understanding of the students' experiences as opposed to delayed interviews.

Qualitative data analysis

The initial transcription of the student interviews was conducted by an AI-driven "voice to text" software tool. However, the quality of some of the transcripts were quite poor and the researchers therefore had to thoroughly compare the raw data sound files with the transcripts and manually correct them, resulting in what [Da Silva \(2021\)](#) describe as semi-automated transcripts. Since the aim of this study was to explore students' conceptions of feedback and their experiences with feedback loops as integrated parts of their three draft writing process we applied a thematic analysis. The thematic analysis is by [Braun and Clarke \(2006\)](#) described as a foundational method for qualitative analysis and it is characterized by the flexibility needed to describe patterns across qualitative data. In the initial coding process *in vivo*- and preliminary coding was applied to recognize main patterns in students' conceptions and experiences ([Silverman, 2019](#); [Saldaña, 2013](#)).

The codes reflected students' general conceptions of feedback, and their experiences with receiving (and giving) feedback, discussing feedback and acting upon feedback during the writing process. Reflecting the students' own perspectives and voices was an important part of the study, and the initial coding of the transcripts therefore prioritized inductive coding over theoretical coding and lifeworld experiences over theoretical coding categories [e.g., [Braun and Clarke, 2006](#); [Rapley in Silverman \(2021, p. 341–356\)](#)]. During the initial coding, patterns of similarities and differences between how the students in the two different context experienced the feedback were revealed (saturation). Student interviews were therefore further analyzed according to theoretically informed categories related to the contextual factors embedded in the assigned feedback contexts. The final categories applied to transcripts from the two contexts are presented in [Table 3](#).

TABLE 3 Overview of the feedback context categories.

Context one (AI-generated feedback)	Context two (peer feedback)
Conceptions of feedback in general	Conceptions of feedback in general
Experiences with receiving AI generated feedback	Experiences with receiving and giving peer feedback
Experiences with dialogic feedback interactions	Experiences with dialogic feedback interactions
Experiences with acting on feedback	Experiences with acting on feedback

Results

Conceptions of feedback in general

Across both contexts, the students were positive about receiving feedback on their schoolwork in general. They emphasized that receiving feedback helped them improve their work and their texts and they all appeared to have a formative view of feedback aligned with assessment for learning. The students linked their conceptions of feedback usefulness to being able to receive and act upon information that could help them uncover blind spots in their work or understanding:

When you have done an assignment for example, it's a bit fun or exciting to get feedback. On what you have done and such [...] If I have done something wrong, and they say it's wrong without me knowing it myself, it's easier to change it (Student 4, context 2).

Students also described their perceptions in ways associated with task- or process level performance, indicating that they find feedback on self-level less useful: “[...] because then you know what to change. What they think of your story. It's fun, and much better than just a thumbs up. It's better that they write what they think instead of just a thumbs up. Then you get a lot more answers.” (Student 1, context 2). However, even if all students said they valued feedback on a general level, patterns regarding their assigned contexts during the three draft writing process seemed to shape parts of their further reasoning. Students assigned to the AI-generated-feedback context mainly pointed at feedback from both teachers and fellow peers as useful: “If I need help in a subject I ask a student. The one sitting next to me. So, he says that maybe you should change this and this, and then you get the correct answer. Like that.” (Student 3, context 1). As opposed to students from context 1 (AI-feedback), students from context 2 (peer feedback) explicitly addressed feedback from peers as less useful despite being asked about general experiences of receiving feedback. Some explicitly linked their view to the formal education of a teacher: “Maybe the teacher knows more. For example, about grammar. And not everyone knows what to assess. So maybe it is easier to trust the teacher then. If you understand” (Student 9, context 2). Others expressed doubting feedback given by fellow students since they might be wrong or not taking the feedback process seriously: “Not everyone takes it seriously, and it's [feedback] not so good from other students. At least I don't take it very much in” (Student 6, context 2).

Students' experiences with receiving AI-generated feedback

During the three draft writing process students assigned to feedback context 1 received AI-generated and transformed feedback. The students described process writing with integrated feedback loops and writing in the EAT system and receive AI-generated as new to them. “It was a bit difficult and confusing at first but got better during the day” (Student 3, context 1). The interviewed students enjoyed working in the program, and many of them explicitly explained how they interacted with the technology and engaged in the received feedback to improve their work: “I thought it was incredibly good. I think you get much more feedback than in word. I think this writing program is better

than word. [...] I saw where the errors were, and then I corrected where there was an error” (Student 2, context 1). “I received feedback that said: (quotes program feedback) here you have three sentences in a row that start with the same word (ends program feedback quoting). It was genuinely like (student makes wow-sound), because I don't usually do that. So that was exceptionally good, because it annoys me when I read other people's texts and they start with the same word several times” (Student 3, context 1). Some students also experienced confusion when the AI-algorithm provided some generic and misaligned feedback information. One student described how the feedback identified a name as a repeating word: “I wrote about Nelson Mandela in the first sentence and had Nelson Mandela as a headline. The others got errors on similar things too. I was a bit confused by that” (Student 3, context 1). The above quote reflects yet another pattern visible: By comparing the generated, transformed and conveyed feedback received, the students were able to detect and reveal generic and misaligned response from the AI-generated feedback.

Students' experiences with receiving (and giving) peer feedback

During the three draft writing process students assigned to feedback context 2 received peer feedback. The students described process writing with integrated feedback loops during a school day as new to them, and both giving and receiving peer feedback was something they had to get used to throughout the day: “It was difficult the first time, to figure out how to assess the different ones. It went fine the second time. Then I knew a little more about what it was like to have to assess” (Student 9, context 2). The interviewed students varied in their description of the feedback they received. Some of them perceived feedback from their peers merely as differences in personal preferences and would not act on the feedback unless feeling sure it could give a higher grade. A common pattern among students from the peer-feedback context was that they differentiated between their fellow peers regarding whether they trusted the feedback to be valuable or not. Their arguments were mainly related to the perceived competence of the peer, the perceived value of the feedback, or both. One student said: “(student name A) wrote wrong on things, and it wasn't so useful, so I didn't take it all in. But (student name B) who sits next to me gave genuinely good feedback. That was very good.” (Student 10, context 2). Some students from the peer feedback context also differentiated regarding who they trusted as recipients of their feedback when they were at the giving end of the feedback process. One student described how they normally don't find it difficult to give feedback to other students but also added: *I didn't dare to give to (student name), because (they) was a bit high on (themselves)* (Student 12, context 2). One student from the peer feedback context ended up in a group with what they describe as “the smart ones in class,” and experienced the feedback provided as particularly useful: “They know where to put commas and full stops. If I had done something wrong, they also showed how to correct it and what it was and such things” (Student 11, context 2). The student further described how fellow students pointed out errors and that they then assisted the understanding of how to correct the errors that were identified. On the other hand, the student also

experienced difficulties as the giver of feedback to the smart ones: *“It was a bit difficult because I’m not that good, and then I was a bit unsure about what to give feedback on. It is difficult to give feedback because I’m not that good in grammar and such things, and then it can be difficult to find errors [...] it’s easier to give feedback on things you’re good at yourself”* (Student 11, context 2). The student further described the feedback giving process as vulnerable.

I’m unsure of myself and think a lot about myself. It becomes a bit personal in a way. And then the others are going to sit and listen. And all eyes are on me. If everything is good, then it’s easier. I think it’s easy (to give feedback) as long as I understand the text, and then I know what to say (Student 11, context 2).

Another student from the peer feedback context used the inherent spelling tool in Microsoft Word to describe their difficulties verbalizing peer feedback information: *“It’s easy to understand that red line means wrong word and blue line means that it is correct, but that the spelling is a bit wrong, or it needs a comma or full stop.”* (Student 13, context 2). The student further said that they wrote too short and could have asked for tips for more content but chose not to do anything with the feedback they got. The student said that it was not so difficult to understand the feedback, but at the same time they pointed out that they found it difficult to read and hence interpret and make use of feedback. *“I didn’t do anything, really. I just continued to do my things, but I listened a bit to it. [...] I have reading difficulties and struggle a bit to keep up, really”* (Student 13, context 2).

Dialogic feedback interactions

When exploring student experiences regarding dialogic feedback interactions the students who received AI-generated feedback (context 1) were generally positive toward the group discussions. Many of the students described and exemplified how the collaborative discussions supported the process of identifying, interpreting, and making use of the feedback and comparisons: *“It was better with group work than if we had just worked one by one. Because then you can talk together and give each other feedback and such. It helps a lot when for example I told them things and then they gave me tips on what I could change.”* (Student 14, context 1). Some students found the discussions useful beyond correcting existing errors. By taking part in group discussions, they experienced being reminded of what not to do in their further draft-writing-process:

I talked to the others at my table. Some of us had the same errors and others not. And then we went through the text and corrected what was wrong. And then we went through the text a few times and moved on to the next stage. It was a good reminder, because when I saw what the others had done wrong - which I might not have done wrong this time, it helped me remember when I was going to write my next draft (Student 3, context 1).

However, the dialogic feedback intentions of the group discussions were experienced to be far less fruitful by students from the peer feedback context (context 2). Some of the students didn’t discuss or explore the feedback received at all and their experiences were limited to merely reading aloud from the assessment rubric sheet without discussing. Others simply exchanged assessment rubric sheets. One student described how the lack of feedback and feedback interactions made them seek feedback elsewhere: *“I didn’t*

get much feedback from the group, so I sought out three others and they gave me feedback and it became easier” (Student 11, context 2). The student further described how their peers emphasized potential grades above providing useful feedback information: *“At first there wasn’t much useful information that could help me improve other than that I was believed to be at a [grade] four or five then” [...] But at the end I realized that I needed more paragraphs, so it would have been nice if someone had brought it up before”* (Student 11, context 2). As previously stated, students from the peer feedback context seemed to struggle even more with the assessor role than with interpreting and making use of feedback they had received. One student summed up their experience of the peer feedback and the following group discussion in the following way: *“We haven’t done this before, so the feedback wasn’t long.”* (Student 15, context 2).

Students’ experiences with acting on feedback during the draft writing process

All student informants across the two contexts agreed that writing a text through a three draft writing process (with integrated feedback loops) was helpful and offered a structured approach to writing. However, they expressed their viewpoints differently, likely influenced by the feedback context they were assigned. All the interviewed students who got AI-generated feedback (context 1) said that they had tried their best to act on the feedback they received:

It was actually very good. The first time I made many mistakes, but after I received feedback, I made fewer and fewer mistakes. Because then you get to check first if what you are doing is correct, and then correct it (Student 16, context 1).

I thought it was nice because then I got to go through the text several times and be completely sure that there were no mistakes. So that you don’t get any grammar mistakes. I would have chosen several drafts again if I could. I thought it was a good way to do it. When I’ve made a mistake, I get the opportunity to correct it (Student 2, context 1).

Many of the students said that the draft writing process with integrated feedback loops helped them to identify and correct mistakes and some explicitly said that it felt like “a safe way to write.” All the students who received and gave peer feedback (context 2) also described the three draft writing process as a good way to write. However, few of them explicitly pointed at the integrated feedback loops as an important aspect of the writing process. Some of them merely stated that they enjoyed getting two breaks during the process of writing, while others were more explicit about the value of the feedback: *“If I had only had one draft then there wouldn’t have been any change, and I wouldn’t have known what was wrong - or what I could change”* (Student 11, context 2). *“I became more motivated to write, and then it was nice that we got breaks in between and didn’t need to be completely quiet. So, we could talk about the story. That was genuinely nice.”* (Student 17, context 2). *“Some words I have been spelling wrong for a long time, because I have been unsure how they are spelled. And now I got answers to some. So that helped me a lot.”* (Student 24, context 2).

Discussion

In this study we explore how lower secondary students from two feedback contexts (peer feedback and AI-generated feedback) experience the process of receiving-, discussing- and acting on language feedback (spelling, punctuation and grammar) during a three draft writing process. The writing trajectory was designed to embed formative feedback loops after the first and second draft, before the third (final) draft was submitted. One class from each of the three participant schools were assigned to the AI-generated feedback context while the other class from each school was assigned to the peer feedback context.

Receiving and discussing feedback

A common argument for implementing peer feedback and dialogic feedback interactions in classroom practices is that active participation in feedback processes could model feedback literacy for learners and thereby support students' development of self-regulated learning (Andrade, 2010; Andrade et al., 2021). This argument rests on the premise that tacit feedback knowledge and feedback literacy might in some contexts be acquired and emerge through observation, imitation, participation and dialogue (Carless and Boud, 2018; Sutton, 2012). In our findings, we see a clear pattern where students who receive AI-feedback express to be more actively engaged in the group discussions than students who receive peer (generated) feedback. Students who received AI-generated feedback found the group discussions both useful and educational whilst the students who received peer feedback generally did not make use of the time set aside for group discussions. Factors embedded in the two feedback contexts could assist our understanding of this finding: Students assigned to the AI feedback context received generated and transformed feedback information (Huang et al., 2023; Munshi and Deneen, 2018) from a software technology they trusted. By pressing the feedback button, they received immediate feedback informed by the software who had acquired activity data about their draft. Students who received feedback from EAT were equipped with automated feedback (including numbers of errors) and examples from their own text before they were expected to discuss their feedback. This makes the feedback information available and understandable, or to use the words of Askew and Lodge (2000): They received "feedback as a gift" before they moved on to discussing the feedback ("feedback as collaborative work").

Students assigned to the peer feedback context faced various challenges. As assessors they looked for language quality in their peers' texts according to an assessment rubric, and some of them were more equipped to identify errors (and point at potential for improvement) than others. The peer assessors also had to actively generate feedback information in written mode and/or oral mode (Brookhart, 2008). Thus, these students were (in various degrees) cognitively and emotionally challenged in the assessor-role before they received feedback on their own texts from their peers (Panadero, 2016; Panadero et al., 2023). Panadero (2016) and Panadero et al. (2023) describe many inter- and intra-personal factors that could influence peer feedback processes, and quote examples in our result section illustrate at least two

key aspects regarding the peer feedback context. The first aspect being: Understanding and realizing the inherent potential for engagement, and acquisition of tacit knowledge through modeling and comparisons can be demanding for 12–13 years old lower secondary students. One cannot take for granted that collaboration and active engagement will occur. The second aspect is: Feeling like a less competent student in a group of more competent fellow students could be a vulnerable situation. And when students are expected to be at both the giving and receiving end of feedback interactions at the same time, the cognitive overload added to the emotional stress could be overwhelming.

Acting upon feedback

As evident in the result section, both groups of students were eager to get feedback which enabled them to correct their errors and improve their work. They all knew that their third draft (final version) of the text would be submitted to their teacher. The students also appreciated the ability to find and correct their mistakes during the three draft writing process, but the group of students who received AI-generated feedback seemed far more satisfied with the integrated feedback loops overall. The very intention of AI-generated and automated feedback technology is its ability to offer feedback that is both immediate and personalized, adapted to each student's needs, providing targeted support that addresses specific areas of improvement (Barrot, 2023; Engeness and Mørch, 2016). This means that technology enhanced feedback should be easy to act on (Huang et al., 2023), Munshi and Deneen (2018). All the interviewed students from the AI-generated feedback context agreed that they had acted upon the provided feedback by the best of their ability. Despite some examples of generic or misaligned responses (Barrot, 2023) in the AI-generated feedback, the students from context 1 trusted the feedback they received. This aligns with the view that AI-generated and automated feedback systems have the potential to increase reliability and validity of feedback, reduce the risk of bias and human mistakes, and that they could thus assist both student learning trajectories and teachers' overall assessment practices (Chen et al., 2020; Richardson and Clesham, 2021).

Students from the peer feedback context did not trust the feedback they received in the same way as students from the AI-generated feedback context did. Some of them talked about peer feedback merely as differences in individual opinions, emphasizing that they would only use the received feedback if they believed it would somehow influence their grade. We also found examples of students experiencing that their peers did not take the feedback process seriously. According to Gielen et al. (2010) peer feedback is an assessment form performed by equal status learners. However, in our study we find many examples of students not perceiving themselves to be equal to the other students in their group. Some students note that they do not trust the peer feedback they receive from fellow students because they do not trust their level of competence. We also see examples of some students having experienced good support from what they call "the brightest students in class" in the receiver end of the feedback loop, whilst simultaneously do not feel that they are able to contribute as feedback givers the other way around. They express uncertainty

about what aspects to provide feedback on and how to use feedback to improve their texts, making the situation challenging for them.

Implications for development of feedback literacy

According to Carless and Boud (2018) developing feedback literacy involves appreciating feedback processes, making judgments, managing affect and taking action (acting), and their framework further supposes that maximizing the mutual interplay of first three features will maximize the potential for students to act on feedback provided. By comparing the two feedback contexts in our study, we have demonstrated that peer feedback processes and engaging in feedback through dialogic feedback interactions require a certain level of feedback literacy or at least supplementary support. Our study indicate that that AI-generated feedback and peer assessment could support lower secondary students' development of feedback literacy in different ways: Students who receive AI-generated feedback information seem to be provided with a starting point for dialogic feedback interactions. The feedback information is easy to understand and could easily be compared. Our study also demonstrate that peer feedback is inherently complex for lower secondary school students, when they are both feedback givers and receivers during a feedback loop. Adding another layer of feedback mode (group discussions) during a three draft writing process seems to overwhelm the students, and especially students with limited feedback literacy. However, by rehearsing the processes of giving and receiving feedback – as provided in the peer feedback context, students must actively involve their judgment and practice how to manage affect. These elements could be key factors in strengthening students' feedback literacy.

Limitations

As noted in the results section the draft writing process with integrated feedback loops (both feedback contexts) was a new experience for the students. The study provides descriptive insights regarding how the students experienced the feedback process in the two contexts but should not be interpreted as a comparative study.

Data availability statement

The datasets presented in this article are not readily available as participants did not give consent to share interview transcripts. Requests to access the datasets should be directed to SM, moltudal@hivolda.no.

Ethics statement

The studies involving humans were approved by the Norwegian Agency for Shared Services in Education and Research (SIKT). The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin. Written informed consent was obtained from the minor(s)' legal guardian/next of kin for the publication of any potentially identifiable images or data included in this article.

Author contributions

SM: Formal Analysis, Writing – original draft, Writing – review and editing. SG: Data curation, Formal Analysis, Writing – review and editing. MS: Data curation, Writing – review and editing. IE: Data curation, Writing – review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

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What does it take for students to value grades for oral participation? Transparency is key

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Introduction: This study addresses the controversy over whether students consider grades accurate indicators of achievement. We focused on grades for oral participation, as teachers rely on informal assessments in assigning these grades, and educational measurement studies have questioned the validity of such assessments.

Methods: Based on two samples of university students (Sample 1: $M = 22$ years, 80% female; Sample 2: $M = 21$ years, 67% female) (Total $N = 431$), we measured whether students perceive grades for oral participation as being reliable indicators of their school achievement. We investigated variations in students' retrospective perceptions of oral participation grades in different school subjects. We also examined how students' retrospective perceptions of oral participation grades were linked to grading transparency and student achievement.

Results: Our findings indicate that students perceive oral participation grades as more accurate indicators of their achievement in languages than in mathematics. Oral participation grades were perceived as being more accurate indicators of student achievement by male students and students who reported greater transparency in the assignment of their grades. In mathematics, higher-achieving students perceived grades as being less valid indicators of their achievement.

Discussion: Our results imply that teachers should be mindful of transparency when assigning grades for oral participation. By increasing the transparency of their grading, for instance, by telling students in advance what aspects they factor into their grading, teachers can help students view grades for oral participation as valid indicators of their achievement and increase procedural and distributive justice.

KEYWORDS

teacher-assigned grades, grading practices, oral participation, informal assessment, transparency

1 Introduction

Teacher-assigned grades are ubiquitous in everyday school life, serving as the basis for important school career decisions, such as promotion to the next grade level (Westphal et al., 2020a), school track recommendation (Klapproth and Fischer, 2019), and university

admission (Zwick, 2019). In addition, grades function as feedback from the teacher to the student and can affect the student's academic self-concept, which is relevant to their further learning behavior (Marsh et al., 2017). When teachers assign grades, they are primarily required to assess the performance of their students. However, teachers also take other factors into account when assigning grades, such as the student's conscientiousness (Westphal et al., 2020b, 2021), academic motivation, and classroom behavior (Close, 2009; Hochweber et al., 2014; Westphal et al., 2016). Report card grades are therefore typically made up of assessments of more clearly structured situations, such as written performance on tests and project or presentation assessments (Organisation for Economic Co-operation and Development [OECD], 2013). However, various assessments of more informal performance situations, such as contributions to class discussions and the quality and quantity of general class participation, are also frequently included (Organisation for Economic Co-operation and Development [OECD], 2013).

Grades for informal performance situations are sometimes summarized as “grades for oral participation,” which can be understood as an umbrella term for various forms of active, mostly spontaneous, participation in class discussion, oral exams, or school project presentations (Krüll, 2023, p. 162–163). In the German school system, in which this study was conducted, grades for oral participation are supposed to account for around 50% of the report card grade, depending on the year level and domain (Falkenberg, 2020). These grades therefore contribute significantly to a student's overall grade and school career; nevertheless, there are few rules or specifications governing how grades for oral participation are determined (Falkenberg, 2020). Research has shown that deviations between teacher-assigned grades and standardized indicators of achievement are particularly pronounced when teachers place more emphasis on informal assessments (Martínez et al., 2009), including class participation. The fact that grades do not exclusively reflect student achievement has sparked a debate over whether they should play a significant role in centralized school career decisions and university admissions (Buckley et al., 2018; Hübner et al., 2020; Trautwein and Baeriswyl, 2007). Some also argue against grades being used as the sole basis for these decisions, as is the case with university placement in some countries, such as Germany. Less focus has been placed on the student perspective, and thus, on the question of how students perceive their grades.

In the present paper, we assessed the extent to which students perceive grades for oral participation as being an accurate indicator of their school achievement and how transparent they perceive these grades to be. We also examined differences in these perceptions across various school subjects. Given that oral skills are particularly relevant in languages (Geva, 2006; Sandlund et al., 2016), but less necessary in mathematics (Pace and Ortiz, 2015), we investigated whether students perceive grades for oral participation as more accurately reflecting their achievement in languages compared to mathematics. In addition, we investigated what it takes for students to perceive grades for oral participation as accurate indicators of their achievement; in particular, the role that perceived transparency plays in this regard. We also tested the hypothesis of whether higher-achieving students regard grades for oral participation—which are based to a lesser extent on actual achievement, and thus, on meritocratic rules—as being less appropriate indicators of their achievement.

1.1 What's in a school grade?

The question “What's in a grade?” (Bowers, 2011) has occupied researchers and educational policy stakeholders for many decades. Teacher education textbooks train teachers to base their grades on the achievement students show in the classroom (Brookhart, 2004; Linn and Miller, 2005). Teachers report using many different indicators when grading student achievement (Brookhart, 1993; McMillan, 2001; Randall and Engelhard, 2009). In assigning grades, teachers not only consider whether students have achieved the learning objectives set in class but also take into account their work habits and degree of effort (Brookhart, 1993; McMillan, 2001; Randall and Engelhard, 2009). According to teachers, however, the achievement that students show in class is the most important aspect of assigning grades (McMillan, 2001; Randall and Engelhard, 2009). These results on the teachers' perspective on grading are supported by large-scale educational studies that have investigated the interplay between teacher-assigned grades and student characteristics; for example, whether students who show more effort in class are awarded higher grades than those who show less effort (Hochweber et al., 2014).

Teacher-assigned grades reflect students' personality, motivation, and behavior in class, as well as their demographic characteristics (e.g., Boman, 2023; Hochweber et al., 2014; Krejtz and Nežlek, 2016; Spengler et al., 2013; Westphal et al., 2016, 2020b). Nevertheless, studies have shown that students' achievement on standardized tests largely explains teacher-assigned grades (Bowers, 2011). However, the extent to which grades reflect performance on standardized tests varies from teacher to teacher and is highly dependent on the form of assessment used (Martínez et al., 2009).

Another important finding of previous empirical research is that teachers differ in how appropriately they can evaluate their students' performance (for meta-analytical evidence see Hoge and Coladarci, 1989; Südkamp et al., 2012). Thus, the appropriateness of school grades differs across teachers (e.g., Hochweber et al., 2014; Westphal et al., 2020b). This can be partially explained by class composition. For example, due to the in-class frame of reference, students in low-performing classes receive better grades for achievement than students in average-performing classes (Dompnier et al., 2006; Marsh, 1987). This big-fish-little-pond effect (Marsh, 1987) explains why teachers may overestimate or underestimate the performance of students in their class. Teachers' professional knowledge and beliefs can also influence their assessment practices (Lam, 2019; Yan et al., 2021), the accuracy of their assessments (Herppich et al., 2010; McElvany et al., 2012), and the appropriateness of the grades they assign (Brunner et al., 2013). Teachers have divergent opinions on the appropriateness of various assessment practices (Martínez et al., 2009). As they have some leeway in assigning grades, they employ a wide variety of assessment practices and base their grade assignments on more- or less-structured written tests, assessment worksheets, or homework assignments (Martínez et al., 2009). When teachers rely more heavily on informal assessments, e.g., class participation, in assigning grades, the grades are more likely to deviate from standardized achievement indicators (Martínez et al., 2009). Such deviations have sparked vigorous debates about whether the allocation of university and apprenticeship placements,

or even assignments to school tracks in multi-tiered school systems, should be based on school grades at all (Buckley et al., 2018; Hübner et al., 2020; Trautwein and Baeriswyl, 2007). However, less attention has been given to the extent to which students perceive grades for oral participation and performance as accurately reflecting their achievement.

1.2 Grades for oral participation

Active oral participation in class is graded implicitly or explicitly in many OECD countries and, in some countries, it constitutes a relevant portion of the report card grade. In a review of student assessment practices in different OECD countries, teachers disclosed that their end-of-year grades were composed of grades assigned for different achievement indicators, such as homework completion, presentations, and class participation (Organisation for Economic Co-operation and Development [OECD], 2013). Active participation is graded for several reasons. First, the development of oral-communicative skills, such as the ability to explain, argue, or discuss, is an important teaching goal in all subjects. In addition, teaching thrives on the active participation of students. Teachers may also want to give students the opportunity to compensate for a poor grade on a written test by earning good grades for regular oral participation, which may better reflect their actual achievement.

Martínez et al. (2009) reported that teachers in the United States view class participation as a more important factor in evaluating students than the child's achievement compared to the rest of the class and local or state-wide standards. In line with these findings, Bainbridge Frymier and Houser (2016) pointed out that "oral participation is generally highly valued in American classrooms and is often thought to be a good indicator of students' engagement in learning" (p. 83). In the United Kingdom, in 1990, a framework for oral assessment across different school levels was introduced into the National Curriculum for English (Department of Education and Science [DES], 1990). This framework was aimed at improving oracy, i.e., students' speaking and listening skills (Thompson, 2006; see also Voice 21, 2022), but Thompson (2006) critically noted that teachers' oral assessment practices seem to be based more on students' oral participation than on the quality of their language. In Germany, grades for oral participation constitute a relevant portion of the report card grade and their weighting in final year grades is 40–60% for most subjects (Krüll, 2023). Some federal states in Germany allow their teachers to determine final grades in some subjects almost entirely based on oral participation, e.g., 100% in the case of history in North Rhine-Westphalia, Germany's most populous state (Langhammer, 1998). Unlike the grading of written tests and exams, however, teachers are given little guidance or direction on how to assign oral participation grades. The core curriculum for secondary education in North Rhine-Westphalia stipulates only that "grading must take into account the quality, quantity, and continuity of contributions" (Ministry for School and Education of the State of North Rhine-Westphalia, 2019, p. 39). Thus, teachers can decide how to define oral participation, what criteria to use in grading it, and how to record performance (Krüll, 2023).

In empirical research, few studies have explicitly focused on grades for oral participation. A recently published interview study

of $N = 232$ teachers from North Rhine-Westphalia showed that in grading oral participation, the teachers primarily focused on the students' thinking, continuous performance, and technical correctness, weighting these criteria more or less equally for all students (Krüll, 2023); nevertheless, 77% of the teachers said they occasionally made exceptions to the use of these criteria. For example, in the case of high-achieving but introverted students, the teachers gave more weight to the quality of oral contributions than to their frequency. A substantial number of teachers also reported that they gave less weight to the oral participation of introverted students in determining their overall grades.

These findings are in line with criteria reported as relevant by 50 teachers in another German study by Mangold (2016). These teachers partially agreed that grades for oral participation were objective, meaning that another teacher would assign the same oral grade during the same evaluation process (Mangold, 2016). Teachers also partially agreed that grades for oral participation were reliable (meaning that repeating the assessment would yield the same oral grade) and valid (meaning that the oral grade actually reflected oral participation). In addition, teachers expressed partial agreement with the assertion that their students concur with the grades assigned for oral participation. Despite this, another teacher stated: "It is impossible to objectively and reliably evaluate oral participation" (Schöneberg, 2015, p. 1). Hence, to what extent is the teacher's view that students agree with their oral grades, as reported by Mangold (2016), true?

1.3 Students' perception of grades

According to Resh and Sabbagh (2016) "a sizeable portion of students seem to experience injustice in reward distribution in schools, both in grade allocations and in teacher-student relations, suggesting that schools are a meaningful source of injustice experiences for students" (p. 360). Yet, few studies have considered students' perspectives on performance assessment, teacher judgments, or teacher-assigned grades. In a series of studies, Resh and colleagues examined whether high school students perceived their grades as just by forming the quotient of the actual grade and their "seen" grade (the grade thought they should have earned) (Jasso and Resh, 2002; Resh, 2010, 2013; Resh and Dalbert, 2007). The authors showed that most students felt "under-rewarded," i.e., they felt they deserved better grades than they received.

In addition, few existing scales capture how students perceive performance assessments, teacher judgments, or teacher-assigned grades (Dorman and Knightley, 2006; Gerritsen-van Leeuwenkamp et al., 2018; Ibarra-Sáiz et al., 2021). The Perceptions of Assessment Tasks Inventory (PATI) (Dorman and Knightley, 2006) has been used most frequently. It comprises subscales that measure congruency with planned learning (i.e., whether teachers' assessments are congruent with the learning goals set in class), authenticity (i.e., whether teachers' assessments include real-life situations), student consultation (i.e., whether students know in advance which form of assessment will be used), transparency (i.e., whether students know the requirements of different assessment methods), and diversity (i.e., whether all students have an equal chance of successfully completing the assessment). The subscales of the PATI and instruments developed

by Gerritsen-van Leeuwenkamp et al. (2018) and Ibarra-Sáiz et al. (2021) refer to the practice of performance assessment by a teacher in their aggregate. They do not focus on how students perceive informal assessment practices. Overall, research on how students perceive informal assessment or grades for oral participation is particularly scarce. As a case in point, a literature search conducted for the present manuscript yielded 120 hits on the Web of Science database, of which 67 could be classified as educational research.¹ However, none of these studies focused on students' perceptions of informal classroom assessments or grades for oral participation.

In addition, grades based on informal assessment or oral participation in class may deviate more from standardized achievement indicators (Martínez et al., 2009). As a result, meritocratic rules are less strictly applied, which students—especially those with higher overall achievement—may perceive as being less fair (Baniyadi et al., 2023). Findings from Israel suggest that male students perceive their grades as being lower than those given to female students (Resh, 2013). In this context, the present study aimed to provide a deeper understanding of how students perceive oral participation grades and the factors that contribute to their perceptions.

1.4 The present study

Although students often orient their learning activities to what they need to accomplish in a course (Biggs et al., 2023; Close, 2009), very few studies have considered students' perspectives on performance assessment, teacher judgments, or teacher-assigned grades. Therefore, the first aim of the present study was to analyze the extent to which students perceive grades for oral participation as being an accurate indicator of their achievement. Since it is particularly important in informal forms of assessment, such as grades for oral participation, that students be informed in advance which achievement-related behaviors will be assessed, we also investigated how students perceive the transparency of oral participation grades:

RQ1a: To which extent do students perceive grades for oral participation as being an accurate indicator of their achievement?

RQ1b: How do students perceive the transparency of oral participation grades?

The second aim of this study was to examine whether these perceptions differ between different school subjects:

RQ2: Do students' perceptions differ between different school subjects?

H2: We hypothesize that students perceive grades for oral participation as being a more accurate indicator of their achievement in languages than in mathematics.

Thirdly, we investigated the factors that may affect students' perceptions regarding the validity of oral participation grades

as indicators of their achievement. Specifically, we studied how perceived transparency and student achievement were associated with the extent to which students perceived grades for oral participation as accurate indicators of their achievement. We controlled for gender, which is associated with students' perception of grades (Resh, 2013; Vogt, 2017). It has been argued that students' perception of grades depends on both the quality and transparency of assessment practices (Annerstedt and Larsson, 2010) and students' achievement in class (Baniyadi et al., 2023). As such, higher-achieving students may value grades less if the assignment of grades is less dependent on overall achievement in class (Baniyadi et al., 2023).

RQ3a: Do students perceive grades as better indicator of their achievement when they perceive greater transparency in the assignment of oral participation grades?

H3a: We hypothesize that students perceive grades for oral participation as being more accurate indicators of their achievement if they see greater transparency in the assignment of grades for oral participation.

RQ3b: Do students perceive grades as better indicator of their achievement when they achieve lower overall grades?

H3b: We hypothesize that students perceive grades for oral participation as being more accurate indicators of their achievement if they achieve lower overall grades.

2 Materials and methods

2.1 Samples

2.1.1 Sample 1

Sample 1 comprised $N = 155$ university students enrolled in different universities in Germany who participated in an online survey during the summer term of 2020. Students were on average 22 years old and in their first year of a bachelor's degree program; 80% were female (Supplementary Table 1).

2.1.2 Sample 2

Sample 2 comprised $N = 276$ university students enrolled at a German university who participated in an online survey between 2020 and 2023. Students were on average 21 years old and in their first or second year of a bachelor's degree program; 67% were female (Supplementary Table 1).

2.2 Measures

2.2.1 Perception of grades for oral participation

Based on the literature, we developed nine items to assess students' perceptions of grades for oral participation. The exact wording of the items is presented in Table 1 (for the German original, see Supplementary Table 2). First- or second-year university students were instructed to retrospectively answer the

¹ The search was based on the search string ("fairness of grades" OR "perception* of grades" OR "transparency of grades" OR "fairness of teacher judgment*" OR "perception* of teacher judgment*" OR "transparency of teacher judgment*" OR "fairness of assessment" OR "perception* of assessment" OR "transparency of assessment") NOT "assessment centers," and was conducted in April 2023.

items for their last two school years and separately for three school subjects: mathematics, German, and English as a Foreign Language (EFL). The items were answered on a 6-point Likert scale (1 = *do not agree at all* to 6 = *totally agree*). Prior to presenting the items, students were asked to indicate whether informal assessment took place in mathematics, German, and EFL and were only presented with the items for subjects for which they indicated that grades for oral participation were assigned.

2.2.2 End-of-semester grades and grade point average

Students reported the end-of-semester grades they had received in mathematics, German, and EFL at school. In the upper secondary years of the German school system, these grades are assigned in a different metric, ranging from 1 (unsatisfactory achievement) to 15 (excellent achievement). In addition, students reported the grade point average (GPA) they had received in their A-levels; these grades ranged from 1 (excellent achievement) to 6 (unsatisfactory achievement). We reverse-coded the grades so that higher grades represented better achievement.

2.2.3 Measure for validation: transparency of grades based on written assessment tests

We used three items from an inventory developed by [Ditton and Merz \(2013\)](#) and adapted their wording to assess the transparency of written assessment in the three school subjects mathematics, German, and EFL (e.g., “When I took exams at school, I usually knew exactly what was going to come up”). Items were answered on a 4-point Likert scale (1 = *do not agree at all* to 4 = *fully agree*). Reliability was acceptable for all three subjects (Cronbach’s $\alpha \geq 0.75$).

2.3 Statistical analyses

2.3.1 Exploratory factor analysis based on data from sample 1

To investigate the factor structure of our nine items assessing students’ perception of grades for oral participation, we performed an EFA with oblique Promax rotation on the Sample 1 data. Three separate EFAs were performed, one for each school subject. The number of items was determined by running parallel analysis and taking into account the screeplot and eigenvalues.

2.3.2 Confirmatory factor analysis based on data from sample 2

To confirm the factor structure, we ran a CFA on the Sample 2 data. In the first step, three separate CFAs were performed for each of the school subjects. In the second step, we specified a CFA in which we incorporated all three school subjects into one CFA model. For all subsequent analyses, we used the latent factor values of the scales. We also probed for measurement invariance across school subjects. Model fit was evaluated based on the comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). CFI values

TABLE 1 Results of the exploratory factor analysis.

	Item	Mathematics			German			EFL		
		M (SD)	AI	TR	M (SD)	AI	TR	M (SD)	AI	TR
1	The frequency of oral participation is a good indicator of achievement.	3.00 (1.43)	0.77	−0.12	3.13 (1.38)	0.54	0.11	3.44 (1.47)	0.60	0.10
2	In my opinion, it is a good idea to have grades for oral participation in addition to grades based on written assessment tests.	4.32 (1.34)	0.75	0.06	4.48 (1.34)	0.75	0.04	4.61 (1.32)	0.83	0.06
3	Grades for oral participation should be a more important part of the overall assessment.	2.50 (1.22)	0.74	−0.03	2.69 (1.24)	0.71	−0.08	2.84 (1.32)	0.68	−0.21
4	Grades for oral participation usually reflect my achievement.	3.93 (1.20)	0.54	0.21	3.99 (1.45)	0.74	−0.06	3.92 (1.46)	0.53	0.21
5	In mathematics/English/German, I think grades for oral participation are too subjective. [recoded] ^a	3.50 (1.49)	0.42	0.24	3.50 (1.35)	0.28	0.48	3.84 (1.29)	0.10	0.49
6	Often it was not clear to me how teachers determined grades for oral participation. [recoded]	3.19 (1.39)	−0.04	0.64	3.41 (1.30)	−0.06	0.65	3.64 (1.49)	−0.03	0.63
7	It was always openly explained to me how my final grade was made up.	3.98 (1.34)	−0.15	0.73	3.87 (1.46)	−0.10	0.62	3.78 (1.37)	−0.09	0.75
8	In general, grades for oral participation were assigned objectively.	3.23 (1.29)	0.05	0.56	3.33 (1.31)	−0.05	0.86	3.49 (1.27)	−0.06	0.74
9	Altogether, I had the impression of receiving fair grades. ^a	4.16 (1.17)	0.11	0.81	4.17 (1.31)	0.40	0.60	4.10 (1.24)	0.15	0.78

AI, Factor loading on the accurate indicator of achievement factor; TR, Factor loading on the transparency of grades for oral participation factor. ^aItem excluded. Higher loadings are printed in bold.

greater than or equal to 0.95, SRMR values greater than 0.08, and RMSEA values smaller than 0.06 indicate good model fit (Hu and Bentler, 1999; Wang and Wang, 2012). Measurement invariance is given when the differences in RMSEA between models are smaller than 0.015 and the differences in CFI values are smaller than 0.01.

2.3.3 One-way repeated measures ANOVA based on data from sample 2

To examine whether students' perceptions of grades for oral participation as an achievement indicator differed between school subjects, we computed a one-way repeated measures ANOVA with school subject as the within-subject factor. Pairwise paired *t*-tests between the different school subjects were computed and the *p*-values were adjusted using the Bonferroni correction method.

2.3.4 Regression analyses based on data from sample 2

We specified regression models in which student perception that grades for oral participation are an accurate indicator of achievement was regressed on student perception of the transparency of grades for oral participation, and actual teacher-assigned grades, controlling for student gender.

2.3.5 Missing data and software

Of our data, 19.2% of Sample 1 and 23.2% of Sample 2 were missing by design, because students had indicated that no grades for oral participation had been assigned. Beyond these missing values by design, 12% of the Sample 1 data and 0.8% of the Sample 2 data were missing. We used the full information maximum likelihood (FIML; Enders, 2001) approach when specifying the CFA models and conducting the regression analyses. The data were preprocessed using R and the CFA and regression analyses were conducted using the R package MplusAutomation (Hallquist and Wiley, 2018). The one-way repeated measures ANOVA was computed using the R package rstatix (Kassambara, 2023).

3 Results

3.1 Developing a measure for students' perception of teacher-assigned grades

In the first step, we conducted an EFA on the nine items based on the Sample 1 data for each school subject. Following O'Connor (2000), we used various indicators to determine how many factors should be retained. Parallel analysis indicated a two-factor solution for perceptions of grades in mathematics and German, and a three-factor solution for perceptions of grades in EFL (Figures 1A-C). For EFL, the eigenvalues also suggested a two-factor solution. We therefore extracted two factors for each subject. When extracting the two factors and comparing the solutions across school subjects, we found that two of our items showed loadings on different factors or high cross-loadings in at least one EFA solution (Table 1). Based on this analysis, we deleted the two items.

To investigate whether the two-factor solution would hold in a CFA, we computed a CFA on the seven items based on the Sample 2 data. After deleting one of the items, we found that the model fit the data well (Table 2). In the third step, we conducted a combined CFA specifying two factors for each of the three school subjects. This combined model also showed a good model fit (Table 3, configural model). We probed for measurement invariance across the three school subjects and found metric invariance (Table 3).

The first factor can be termed "achievement indicator," reflecting the perception that grades for oral participation are a reliable indicator of achievement. The second factor can be termed "transparency," reflecting the perception that grades for oral participation were assigned transparently. The bivariate correlations between the two latent factors were $r = 0.35$ in EFL and $r = 0.38$ in both mathematics and German, indicating that both factors were related to some extent (Table 4). The correlations for the latent factor "achievement indicator" across subjects were substantial ($0.52 \leq r \leq 0.68$), as was the correlation for the latent factor "transparency" across subjects ($0.45 \leq r \leq 0.56$) (Table 4).

The means, standard deviations, and reliabilities for the two scales are shown in Table 4. McDonald's Omega was acceptable for the achievement indicator construct and for the transparency construct in German and EFL, but was lower for the transparency construct in mathematics. Correlations between the latent factors and teacher-assigned grades showed that only the transparency construct was associated with grades (Table 5). Students with better grades in the respective school subject perceived the grades for oral participation as being more transparent. Correlations between the latent factors and transparency of formal assessment are also presented in Table 5. The transparency construct was associated with transparency of formal assessment in the respective subject. Students who reported greater transparency of formal assessment also perceived the grades for oral participation as being more transparent. However, correlations were in the medium range, indicating that perceived transparency in grades for oral participation and transparency in grading based on formal assessment depict different constructs.²

3.2 Differences in students' perceptions of grades for oral participation between subjects

To explore variations in student perceptions of the accuracy of oral participation grades as indicators of achievement between mathematics, EFL, and German, we ran a one-way repeated measures ANOVA with school subject as the within-subject factor (mathematics vs. German vs. EFL). The achievement indicator construct was statistically different for the different school subjects, $F(1, 340) = 103.76$, $p < 0.001$, generalized $\eta^2 = 0.04$. *Post-hoc* tests with Bonferroni adjustment indicated that all the pairwise differences showed statistically significant differences ($p < 0.001$). Thus, students perceived grades for oral participation as being a better indicator of their achievement in EFL than in German and as a better indicator of their achievement in German than in mathematics.

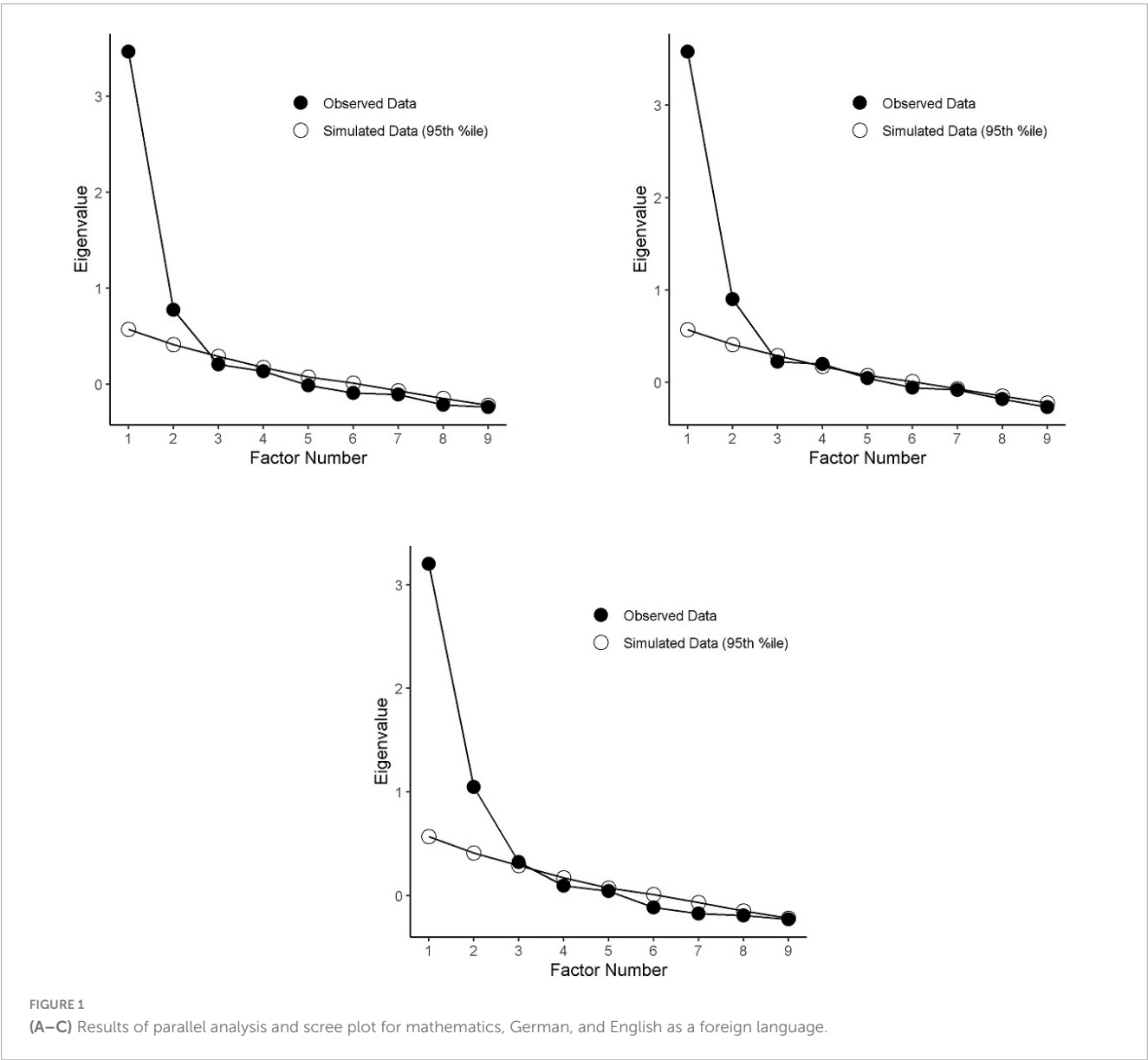


TABLE 2 Model fit of the confirmatory factor analysis for each school subject and intercorrelations.

	Free parameters	Model fit indices					
		AIC	BIC	CFI	TLI	RMSEA	SRMR
Mathematics	19	3555.278	3615.517	1.000	1.000	0.000	0.032
German	19	4495.614	4560.688	0.993	0.987	0.029	0.028
English	19	4523.524	4588.765	1.000	1.000	0.000	0.018

TABLE 3 Measurement invariance across school subjects.

	Free parameters	Model fit indices					
		AIC	BIC	CFI	TLI	RMSEA	SRMR
Configural	87	11900.726	12207.787	0.986	0.979	0.027	0.045
Metric	79	11891.111	12169.936	0.987	0.983	0.024	0.046
Scalar	70	11909.943	12157.003	0.968	0.958	0.038	0.054

TABLE 4 Mean, standard deviation, McDonald’s Omega, and intercorrelation of latent factors.

	<i>M</i>	<i>SD</i>	ω	Mathematics		German		EFL	
				MA AI	MA TR	GE AI	GE TR	EFL AI	EFL TR
MA AI	3.22	0.72	0.74	–					
MA TR	3.27	0.77	0.64	0.38***	–				
GE AI	3.36	0.79	0.74	0.68***	0.25**	–			
GE TR	3.50	0.79	0.68	0.26**	0.56***	0.38***	–		
EFL AI	3.59	0.75	0.73	0.52***	0.23*	0.57***	0.27**	–	
EFL TR	3.74	0.75	0.69	0.13	0.52***	0.10	0.45***	0.35***	–

MA, Mathematics; GE, German; AI, Grades for oral participation as an accurate indicator of achievement; TR, Transparency of grades for oral participation. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

TABLE 5 Intercorrelation of latent factors with grades and transparency of grades based on written assessment tests.

	Grades				Transparency of grades based on written assessment tests		
	GPA	Math	German	EFL	Mathematics	German	EFL
MA AI	–0.03	0.02	–0.07	–0.07	0.13	0.06	–0.07
MA TR	0.24***	0.26***	0.08	0.14*	0.39***	0.14*	0.21**
GE AI	–0.04	–0.02	–0.03	–0.06	0.04	0.13*	–0.12
GE TR	0.21***	0.16*	0.17**	0.18**	0.16*	0.38***	0.14*
EFL AI	0.01	0.04	0.01	0.11	0.13	0.10	0.15*
EFL TR	0.22***	0.19**	0.12	0.30***	0.32***	0.19**	0.46***

MA, Mathematics; GE, German; AI, Grades for oral participation as an accurate indicator of achievement; TR, Transparency of grades for oral participation. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

3.3 Factors affecting students’ perceptions of whether grades for oral participation are an accurate indicator of achievement

To examine the relationship between students’ achievement indicator perceptions, transparency perceptions, teacher-assigned grades, and gender, we computed regression models separately for each of the school subjects (Table 6). When taking into account student grades and gender, student transparency perceptions were a strong predictor of achievement indicator perceptions. Beyond transparency perceptions, male students perceived grades for oral participation as being a better indicator of achievement. In mathematics, students with lower end-of-semester grades perceived grades for oral participation as being a better indicator of achievement. In EFL and German, teacher-assigned grades were not significantly associated with the achievement indicator construct. The model explained 30% of the variance in students’ achievement indicator perceptions in mathematics and German and 31% of the variance in EFL.

4 Discussion

Students receive grades almost daily in school. Teachers assign grades based on a wide range of practices, from standardized tests to informal assessments (Martínez et al., 2009), and the evaluation of active and oral participation in class plays an important role in the process of grading. In Germany, for example, teachers are required to assess only around half of their report card grades

based on written performance (e.g., tests) and the other half based on oral participation. In addition, informal assessments play an important role in progressive teaching formats, which focus more on self-regulated learning and in which students pursue different learning objectives (Sliwka and Klopsch, 2022). Generally, grades are associated with numerous consequences for students, some of which are highly significant (e.g., Westphal et al., 2020a). However, little is known about how students perceive the assignment of grades. In particular, perceptions of informal assessments, such as grades for oral participation, have rarely been studied. In the present study, we addressed this research gap by measuring how students perceive grades for oral participation. We also examined variations in these perceptions between different school subjects. Moreover, this study investigated the factors that contribute to the perception of grades for oral participation as being an accurate indicator of achievement.

4.1 Do students perceive grades for oral participation as being valid indicators of their achievement?

The students in our study only partially agreed that grades for oral participation are valid indicators of their achievement. However, the perceptions that oral participation grades are a more or less valid indicator of achievement varied for different school subjects. Students perceived grades for oral participation in EFL as being a more valid indicator of achievement, while they perceived them as being a less valid indicator of achievement in mathematics. This can be explained by the fact that learning foreign languages is

TABLE 6 Regressing students' perception of grades for oral participation as a valid indicator of achievement by students' perception of transparency, grade, and gender.

	<i>b</i>	<i>SE</i>	95% CI		β	<i>p</i>
			<i>LL</i>	<i>UL</i>		
Mathematics						
Intercept	1.86	0.18	1.50	2.22		0.000
Mathematics transparency	0.46	0.05	0.36	0.56	0.50	0.000
Mathematics grade	−0.02	0.01	−0.05	0.00	−0.12	0.037
Gender ¹	0.29	0.08	0.12	0.45	0.19	0.001
Adjusted <i>R</i> ²	29.9					
German						
Intercept	1.78	0.22	1.35	2.20		0.000
German transparency	0.48	0.05	0.38	0.59	0.50	0.000
German grade	−0.02	0.01	−0.05	0.01	−0.08	0.136
Gender ¹	0.31	0.09	0.13	0.48	0.19	0.001
Adjusted <i>R</i> 2	30.4					
English as a Foreign Language						
Intercept	1.71	0.21	1.30	2.13		0.000
EFL transparency	0.50	0.05	0.39	0.61	0.52	0.000
EFL grade	−0.01	0.01	−0.03	0.02	−0.03	0.604
Gender ¹	0.29	0.08	0.13	0.46	0.19	0.001
Adjusted <i>R</i> 2	30.8					

¹Reference: female.

particularly concerned with oral skills (Geva, 2006; Sandlund et al., 2016), whereas these are also necessary in mathematics (Pace and Ortiz, 2015), but to a much lesser extent.

4.2 What contributes to students' perceptions that grades for oral participation are a valid indicator of achievement?

When examining the factors that contribute to students' perception that grades for oral participation are a valid indicator of their achievement, our findings showed that transparency, i.e., the perception that grades for oral participation are assigned transparently, was particularly crucial. This finding is consistent with the notion that the perception of grades and their legitimacy largely depends on the quality and transparency of assessment practices (Annerstedt and Larsson, 2010). Whereas students' perception of grades as being a valid indicator of achievement has been framed as reflecting distributive justice (Resh and Sabbagh, 2017), students' perception of grading transparency could be seen as reflecting procedural justice. Procedural justice—defined as “evaluations regarding the justness of the processes (or means) by which these resources are distributed” (Resh and Sabbagh, 2017, p. 390)—is relevant for students' school engagement and community volunteering (see Resh and Sabbagh, 2017), although these authors operationalized it differently than we did in our study. In addition, greater distributive justice of grade allocation is linked

to lower levels of academic dishonesty and violence (Resh and Sabbagh, 2017). While our findings indicate that these two aspects of justice are closely intertwined, each may be of distinctive value for transmitting civic norms that are crucial in a democratic society (Resh and Sabbagh, 2017).

In mathematics, students with lower end-of-semester grades perceived grades for oral participation as being more valid indicators of their achievement. This finding may reflect the notion that higher-achieving students value grading practices that are closely aligned with meritocratic rules (Baniasadi et al., 2023). In mathematics, grades for oral participation may diverge to a greater extent from more standardized forms of classroom assessment, which could explain our finding that higher-achieving students consider grades for oral participation as being less valid. In contrast, lower-achieving students—i.e., those who score lower on more standardized and written test formats in mathematics—may value the chance to improve their grades in mathematics by contributing to class discussions or generally participating actively in class. In German and EFL, end-of-semester grades were not associated with students' perception that grades for oral participation are an accurate indicator of their achievement. It is possible that—in these subjects, at least—grades for oral participation that reflect the quality and quantity of general active participation in class are more closely aligned with scores based on standardized tests. Students who show better overall achievement in languages may therefore not consider grades for oral participation in these subjects as diverging from meritocratic principles.

Finally, female students perceived grades for oral participation as being less valid indicators of their achievement. This finding

contradicts previous research indicating that if gender differences in perception of grades exist, it is male students who feel that grades are more unjust (Correia and Dalbert, 2007; Jasso and Resh, 2002; Resh and Dalbert, 2007). Jasso and Resh (2002) interpreted these feelings as reflecting (somewhat inconsistent) findings indicating that female students receive more favorable grades (e.g., Heyder et al., 2017; but see also Westphal et al., 2016). These studies on male students' greater perceptions of injustice in their grades focused on overall grades and did not control for actual end-of-term grades, which may explain the differential findings of the present study. Our finding that female students perceive grades for oral participation as being a less valid indicator of their achievement than male students seems more straightforward for mathematics than for languages. In mathematics, female students have lower expectations for success (Parker et al., 2020) and may therefore feel less confident about active class participation even when they show similar levels of achievement as male students. In languages, however, female students have higher expectations for success than male students (Parker et al., 2020). In addition, previous findings indicate that extraversion—associated with greater class participation—is beneficial for female students' overall grades in languages, but not for male students (Spinath et al., 2010). Therefore, it is surprising that female students perceived grades for oral participation as being less valid indicators of their achievement not only in mathematics but also in languages. Qualitative interviews could be informative in explaining why female students perceive grades for oral participation as less adequately representing their achievement.

4.3 Limitations and implications for future research

Our study exhibits some limitations. First, we only assessed students' perceptions retrospectively, which may introduce a recall bias. Future studies should apply our instruments in an active school context, taking into account the shared perceptions of all students in the classroom, information about the grading practices of the teacher (e.g., frequency of giving grades for oral participation), and ideally, external ratings of the transparency of informal assessments. In addition, our findings are based on informal assessment practices that are common in the German school system. Informal assessment practices in primary school and other school systems may differ from those in higher secondary schools in Germany. Therefore, our findings are not easily generalizable to the assessment of younger students and other countries. Finally, our study does not consider the extent to which aspects of the teacher–student relationship or perceived instructional quality affect perceptions of informal assessments.

5 Conclusion and educational implications

The validity of grades has often been studied from an educational measurement perspective (Martínez et al., 2009). Based on this research, the incremental validity of grades above and beyond standardized test scoring has been a matter of controversy

(Zwick, 2019). The present study sheds light on the student's perspective on this issue. This study focused on perceptions of grades for oral participation, where teachers rely more heavily on informal assessments, the validity of which has been particularly questioned in educational measurement studies. We found that in mathematics in particular, higher-achieving students perceived grades for oral participation as being less valid indicators of their achievement. In languages, students—regardless of their level of achievement—perceived grades for oral participation as being more accurate indicators of their achievement. The transparency with which grades for oral participation are assigned is closely related to students' perceptions of how valid they are. Our findings have important implications for questions on the distributive justice of school grades.

The predictive power of high school grades for college success is higher than that of admission tests, in part because grades do not exclusively reflect achievement (Galla et al., 2019). At the same time, this aspect raises the question of distributive justice when important decisions, such as admission to university, are based on grades assigned by teachers. To increase procedural and distributive justice, instructors should be mindful of transparency, especially when using informal assessments to assign grades, such as when assigning grades for oral participation. By increasing the transparency of their grading, for instance, by telling students in advance what aspects they factor into their grading, teachers can help students view grades for oral participation as valid indicators of their achievement. Another aspect that needs to be considered is that performance grading can reduce intrinsic motivation, as it can undermine the basic needs for autonomy, competence, and connectedness (Krijgsman et al., 2017), which, according to self-determination theory, are fundamental for intrinsic motivation (Deci and Ryan, 2000). Yet, “the motivational impact of grading is likely to depend on its functional significance” (Krijgsman et al., 2017, p. 202; Vansteenkiste et al., 2008). If students perceive grades less as information about their learning and more as a performance evaluation, this may have greater affective and motivational consequences (e.g., Ryan and Brown, 2005). As such, students may feel pressured to perform well (autonomy frustration), might feel like a failure when receiving or anticipating low grades (competence frustration), or may feel rejected when anticipating their peers' reactions to a bad grade (relatedness frustration; Krijgsman et al., 2017). Accordingly, it may be particularly important that teachers “induce feelings of choice or freedom, feelings of connection to others, and opportunities to reach criteria (i.e., need satisfaction), while also reducing feelings of pressure to perform well, feelings of rejection by others, and feelings of failure (i.e., need frustration) in order to stimulate positive motivational and affective experiences” (Krijgsman et al., 2017). If the legal regulations in the school system and the circumstances at the individual school allow it, it may be in the best interest of learners to use alternative forms of performance feedback, such as competency grids, grading rubrics, narrative assessments, and student self-assessment techniques. These approaches could better meet basic needs according to self-determination theory and could also be beneficial in the context of civic education. If performance grading is indispensable because grades are needed, e.g., for selection and allocation decisions (Westphal, 2024), it is essential that grades are assigned transparently. This is crucial because the perception by students that grades are assigned in a fair and just manner

can be conducive to students' civic behavior (Resh and Sabbagh, 2017). Most of all, however, the transparency of the assignment of grades—in terms of perceived distributive justice—has a value of its own.

Data availability statement

The data used for the current study are available from the corresponding author upon reasonable request.

Ethics statement

Ethical approval was not required for the studies involving humans because the Ethics Committee of the University of Potsdam issues ethics votes for planned intervention studies or studies in which vulnerable persons are examined or in which the participants are not informed (objectives of the study must be concealed) or in which there is pressure to commit, so that it cannot be ensured that participants participate voluntarily. None of these points were present in this case. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

AW: Conceptualization, Formal Analysis, Methodology, Writing – original draft, Writing – review & editing. CH: Formal Analysis, Methodology, Writing – review & editing. MV: Conceptualization, Investigation, Resources, Writing – review & editing.

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Supplementary material

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The current landscape of formative assessment and feedback in graduate studies: a systematic literature review

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Formative assessment has evolved into a comprehensive approach for enhancing student learning across academic levels, yet gaps remain regarding its impact on graduate students with diverse needs. This study conducts a systematic literature review (SLR) of empirical research published between 2014 and 2024, analyzing 188 initial articles retrieved from Scopus and Web of Science, which were narrowed down to 19 eligible studies. The aim is to examine how formative feedback influences the learning and motivation of graduate students. The results indicate that: (a) immediate and specific feedback enhances academic performance and promotes self-regulation, empowering students to manage their learning processes more effectively; (b) technological tools facilitate personalized and accessible feedback, tailoring learning experiences to individual needs; and (c) the implementation of feedback strategies that consider individual differences contributes to greater equity and effectiveness in graduate education. This study not only addresses gaps in the literature by synthesizing evidence on formative assessment but also highlights the transformative role of technology and personalized strategies in promoting autonomous and meaningful learning in graduate programs.

KEYWORDS

formative assessment, immediate feedback, graduate education, self-regulation of learning, personalized learning, educational technologies

1 Introduction

In the field of education, and particularly in graduate programs, formative assessment has emerged as a key practice for fostering deep and meaningful learning. In this regard, [Atwa et al. \(2024\)](#) demonstrated that formative assessment, accompanied by timely and specific feedback, improves conceptual understanding, reduces anxiety, and enhances students' academic performance. Similarly, [Merula and Thiery \(2023\)](#) highlight the importance of continuous dialogue between teachers and students in this process, aiming to create a positive teaching and learning experience.

In the context of graduate studies, Cañadas (2023) points out that formative assessment goes beyond measuring knowledge; it contributes to the development of essential skills such as critical thinking, problem-solving, and teamwork. Yan et al. (2021) emphasize the importance of feedback aimed at developing competencies at this educational level. Moreover, Hattie and Timperley (2007) and Vaughan and Uribe (2024) agree that timely and specific feedback, along with a clear understanding of assessment criteria, is essential for students to regulate their own learning and prepare for the challenges of the professional world.

This shift toward a more learning-focused assessment is theoretically supported by constructivism and competency-based approaches. Piaget (1980) and Vygotsky (1978), whose theories have been fundamental to understanding the active role of students in constructing their knowledge, laid the foundation for this perspective. In particular, Vygotsky (1978) emphasized the role of the social environment and collaborative learning in cognitive development. Later researchers, such as Black and Wiliam (2010), Menéndez et al. (2019), and Anijovich and Cappelletti (2020), expanded on this view by highlighting the importance of formative assessment not only as a tool for monitoring academic progress but also as a means to promote deep learning and the development of key competencies. From a sociocultural approach, Shepard et al. (2018) offer a broader interpretation, explaining how motivational factors, such as self-regulation and self-efficacy, are intimately linked to cognitive development. This theoretical framework suggests that effective formative assessment should go beyond simply measuring knowledge, actively promoting the development of skills and competencies essential for the academic success of graduate students.

In the context of graduate programs, formative assessment takes on particular relevance due to the specific demands of this educational level, such as the promotion of autonomy and research capabilities. Juwah and Macfarlane (2004) pointed out that at the graduate level, formative assessment must be more flexible and personalized, responding to the individual needs of students. This approach is key to fostering the development of advanced competencies. Andriamiseza et al. (2023) reinforce this perspective by emphasizing the importance of specific feedback oriented toward competency development at this educational level. Similarly, Boud and Falchikov (2006) argue that formative assessment not only encourages reflective learning but also contributes significantly to students' professional development, preparing future researchers to face challenges in their respective disciplines. Furthermore, Leenknecht et al. (2021) demonstrated that formative assessment has a positive impact on motivation, retention, and the transfer of learning, which are essential factors for success in graduate programs.

Despite the growing relevance of formative assessment in graduate studies, its effective implementation presents significant challenges that have not yet been fully addressed in the literature. Although several studies have explored formative assessment in general educational contexts, a significant gap remains regarding the limited high-quality evidence base supporting efficient formative assessment practices in graduate programs. This lack of robust evidence hinders the adoption of evidence-based practices. Moreover, the outcomes of formative assessment depend on the level of implementation and the specific context in which it is

applied, leading to variations in the strategies used and their results (Morris et al., 2021). Additionally, it is essential to consider the unique characteristics and academic needs of graduate students, which naturally differ significantly from those of other educational levels. Friedrich-Nel and Mac Kinnon (2015) pointed out that research on the impact of formative assessment on motivation, retention, and learning in graduate students remains limited and fragmented. Moreover, there is little clarity about which teaching practices are most effective for implementing formative feedback that influences autonomous learning and the acquisition of advanced competencies at this level.

This research gap is particularly relevant in the context of the growing cultural diversity of graduate programs and the complexity of their curricula. Therefore, the objective of this study is to conduct a systematic literature review (SLR) of the past 10 years, focusing on empirical research on formative assessment. The aim is to analyze, process, and synthesize the characteristics, perceptions, impact, influence, and innovations of formative assessment on the learning outcomes of graduate students. By fulfilling this objective, it is expected to contribute to the enrichment of the academic debate on best practices in formative assessment in graduate programs. This research is justified by the need to synthesize recent empirical studies that explore formative assessment in the graduate context. Although research on formative assessment has grown in recent decades, significant gaps persist regarding its application at this educational level.

2 Background

2.1 Formative assessment in graduate studies

The purpose of formative assessment is to foster conscious and responsible learning in students through a systematic evaluation structure and a continuous support process provided by teachers. Beyond simply measuring academic progress, formative assessment offers students the opportunity to visualize their progress, identify areas for improvement, and strengthen their autonomous learning, which is especially relevant in the context of graduate studies (Cruzado Saldaña, 2022). The main objective is not only to assess performance but also to analyze the strategies and actions necessary to redirect and optimize the learning process. In this sense, evidence of achievement is used by both teachers and students to understand the learning processes and outline the path to better results (Mandinach and Schildkamp, 2021). The adoption of autonomy and self-regulation becomes a priority, and formative assessment serves as a key tool to improve continuous performance in an educational environment that demands high levels of specialization and critical reflection (Anijovich, 2017). Thus, in graduate studies, formative assessment not only supports academic progress but also guides continuous improvement and the adaptation of teaching strategies to maximize learning.

In graduate programs, formative assessment becomes essential due to the need to foster critical and reflective autonomy in students. Asiú et al. (2020) note that, at this educational level, the roles of teachers and students are complementary, as continuous feedback allows the learning process to be adjusted

and personalized. From a process-centered perspective, formative assessment provides relevant information about the construction of learning and allows for adjustments in pedagogical strategies to improve achievement levels (Fernández Leandro et al., 2022). In this context, assessment is not only used to verify competencies but also as a tool to redirect the teaching-learning process and promote self-regulation and self-management of knowledge. This approach offers students a continuous opportunity for improvement, as formative assessment, being a cyclical process of feedback and adjustment, becomes a means to drive new ways of learning, supported by effective teacher guidance (Cabral, 2010; Fernández Leandro et al., 2022).

2.2 Feedback as the main benefit of formative assessment

When discussing teaching and learning processes, it is essential to frame the evaluation process as a mechanism that provides meaningful feedback and ensures the achievement of learning objectives (Louhab et al., 2018). Formative assessment stands out for its primary benefit of offering feedback and support to both students and teachers, with the aim of optimizing performance levels, achieving objectives, and informing decisions related to learning (Muñoz Velasco and González Serrano, 2024). Feedback is a key component of formative assessment, allowing students to adjust their learning processes based on information provided by their teachers. This enables them to reflect on their performance and make informed decisions to improve future tasks (Fiskerstrand and Gamlem, 2024). It engages students and prepares them to enhance their learning (Guevara Fernández et al., 2024).

This process extends beyond simply correcting errors; it fosters ongoing dialogue between students and teachers, promoting a more active, in-depth, and meaningful learning process (Vattøy et al., 2022). The goal is to improve the achievement of learning objectives. By integrating feedback into the assessment process, an environment is created where students not only receive comments on their performance but also develop critical skills such as self-regulation and critical thinking (León-Wharton, 2021).

Formative feedback not only informs but also encourages critical analysis and continuous improvement, establishing itself as an essential pillar for maintaining a high level of academic engagement. Quality feedback strengthens this engagement when it helps students envision future learning and involves emotional resonance (Dávila Ramírez and Huertas Martínez, 2024).

Formative feedback has become a cornerstone in the educational process, significantly contributing to students' academic engagement (Sánchez Valdez and Carrión-Barco, 2021). Similarly, Dorencelle and Mollo (2022) emphasize that "an integrated formative feedback model fosters constant dialogue between teachers and students." Furthermore, feedback should not only be informative but also reflective, promoting critical analysis and continuous improvement in professional development (Saiz-Linares and Susinos-Rada, 2018).

At the postgraduate level, there are results about the effect of formative assessment on students, Borter (2024) analyzed exhaustively the effects that can be observed, he considered

additional formative evaluations apart from the scheduled ones, so, his findings suggest improvement and positive impact on learning for postgraduate psychology students who received this additional contribution from the formative assessment; nevertheless, this also reveals variations in the self-regulated learning behavior and the level of time and effort invested in activities by the students. Statistically, the improvements in the final test results were significant for the ones who participated in additional formative assessments and dedicated more time and effort, they reached a measurement of $d = 0.33$ (measured with Cohen's d), while the ones who did not invest many resources obtained lacking or low significance improvements.

Following this, Sabale et al. (2022) highlights the formative assessment relevance in the postgraduate student's comprehensive development. By providing opportune and personalized feedback, this not only enhances the academic performance but also fosters skills such as self-regulation, problem-solving, and critical thinking. By adapting the assessment strategies to each student needs, institutions can ensure a meaningful and lasting learning.

2.3 Impact of formative feedback on academic engagement

Dorencelle and Mollo (2022) highlight that an integrated formative feedback model can transform the educational experience, increasing students' academic engagement and enabling them to take an active role in their learning. This approach prioritizes not only correction but also the development of autonomous learning and critical reflection, essential elements in graduate education. Sorkar Gómez (2021) points out that formative assessment, when focused on the learning process rather than the final product, improves the quality of learning and promotes active participation in planning and evaluating one's progress. The constant interaction between teachers and students, through detailed and growth-oriented feedback, fosters sustained motivation and deep academic engagement (Sánchez Valdez and Carrión-Barco, 2021). This type of feedback not only enhances academic performance but also supports the development of critical competencies that students will need throughout their professional careers.

2.4 Innovations in formative assessment

In recent years, formative assessment has gained particular relevance due to innovations that have enabled its adaptation and personalization through the use of digital technologies. The integration of technological tools has transformed teaching-learning processes, facilitating interaction, and continuous monitoring of students' progress (Katuk, 2019; Varlakova et al., 2022). These innovations have not only expanded the possibilities of formative assessment but have also created more collaborative and motivating learning environments, improving students' active participation (Webb et al., 2018). Furthermore, adaptive approaches, such as lesson study and personalized methodologies, have allowed students to advance at their own pace, increasing the quality of learning and self-determination (Fiskerstrand, 2021;

Thinwiangthong et al., 2020). In this context, formative assessment continues to evolve as a key tool for maximizing learning in the graduate setting, providing a more flexible approach tailored to students' needs.

2.5 Influence of formative assessment on learning achievement and competencies

There is extensive documentation on the influence of formative assessment on learning achievement and competency development. One of the essential components of this process is feedback, in which students' active participation plays a crucial role, as it directly impacts learning achievement (Van der Kleij et al., 2019). Additionally, immediate and effective feedback is key to enabling students to recognize their shortcomings and identify opportunities for improvement (Hattie and Timperley, 2007). Formative assessment fosters students' active participation in their learning process, promoting the acquisition of self-regulation skills that positively influence long-term learning, as it allows students to plan, monitor, and evaluate their own progress in a sequential manner (Panadero, 2017).

One of the main benefits of formative assessment is that it allows for personalized learning, providing teachers with detailed information about students' progress. This facilitates the adaptation of individual methodologies, which in turn contributes to more effective learning (Black and Wiliam, 2018). Additionally, by involving students in self-assessment and peer assessment processes, motivation and engagement increase, as they take greater responsibility for their own learning (Nicol and Macfarlane-Dick, 2006), thus promoting deeper learning.

Currently, formative assessment also contributes to the development of essential competencies in the technological field, which are critical in a constantly changing world. Feedback in simulated learning environments, facilitated by the use of information technologies, allows students to refine technical and professional skills, preparing them for entry into the labor market (Boud and Molloy, 2013). Additionally, the use of these technologies enhances students' digital competencies, fostering more effective interaction among them (Ghomi and Redecker, 2019).

Finally, it is worth noting that formative assessment not only focuses on the knowledge to be acquired but also facilitates the development of cognitive competencies such as critical thinking and conflict resolution (Sadler, 1989), socio-emotional competencies such as empathy and resilience (Durlak et al., 2011), and collaborative competencies such as teamwork skills. Peer assessment activities, in particular, promote more effective communication among students, fostering collaboration and teamwork (Johnson and Johnson, 2009).

3 Methods

To conduct this research, a systematic literature review (SLR) was chosen as it represents a rigorous methodology. The process is carried out in a precise, transparent, and comprehensive manner, making it replicable—in other words, other researchers can repeat

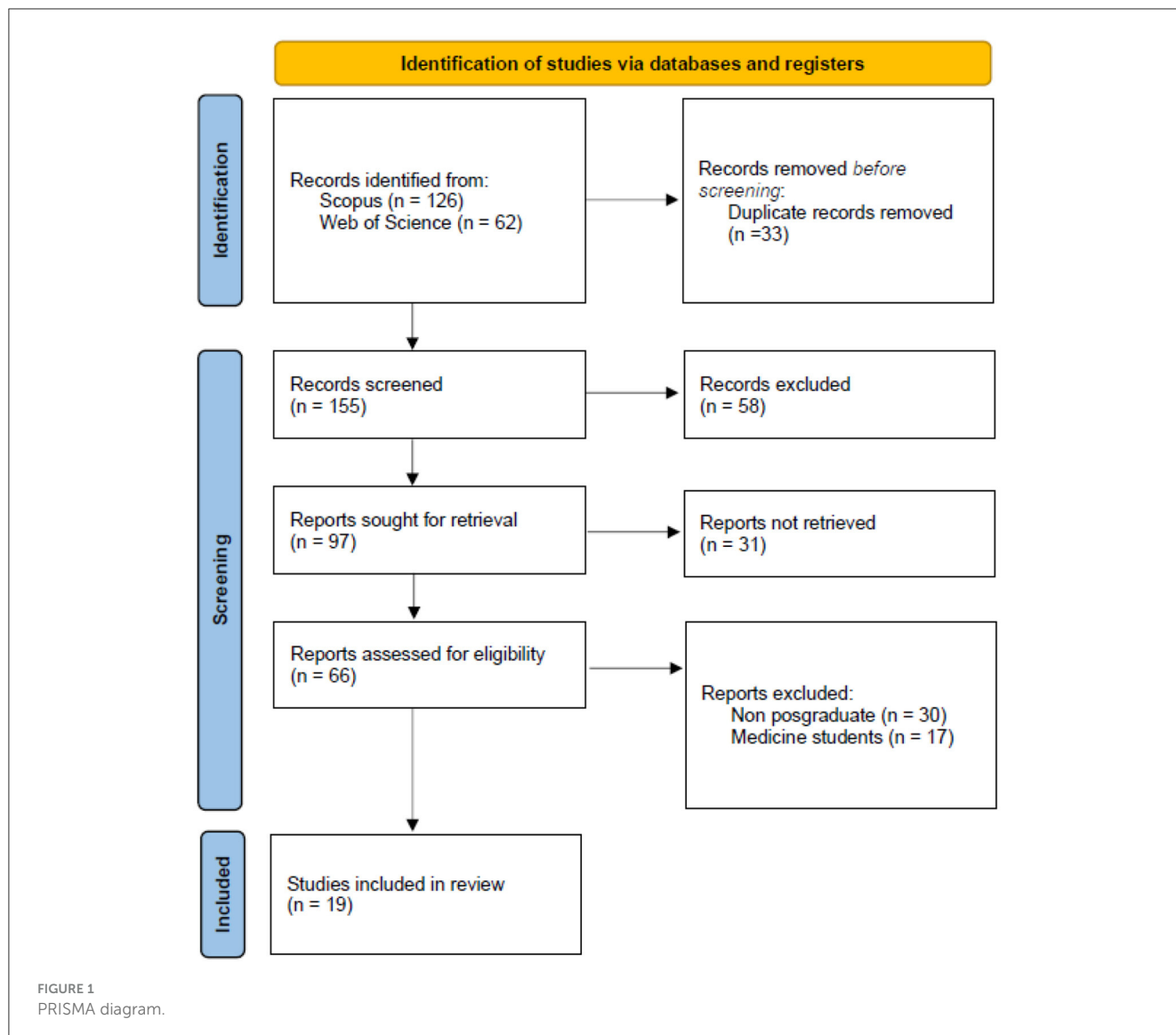
the procedure to obtain similar results. The goal of an SLR is to minimize research bias and maximize the transparency and reproducibility of findings (Azarian et al., 2023; Rogge et al., 2024). The foundation of an SLR lies in clearly, specifically, and systematically defining the rules and procedures for conducting the research, including the search, selection, and evaluation of studies, thereby ensuring the thoroughness and objectivity of the review (Elsman et al., 2024).

The SLR underscores its importance through its inherent ability to provide a comprehensive and updated overview of a specific field of study. It is particularly valuable for identifying thematic gaps in the literature, supporting evidence-based decision-making, and contributing information for future research (Salih, 2024). The associated benefits are diverse: it enables the identification and synthesis of available evidence, thereby reducing selection bias (Mishra and Mishra, 2023); it enhances transparency and reproducibility in research through clear procedural definitions and thorough documentation (Rogge et al., 2024); and it fosters the generation of relevant research questions by identifying gaps in the literature (Salih, 2024). The selected databases for this search were Scopus and Web of Science, both recognized for their high reputation and academic rigor (Pranckute, 2021; Vera-Baceta et al., 2019).

To ensure an efficient and accurate search of the literature, boolean operators were employed in the database queries. These operators, such as AND, OR, and NOT, allowed for the logical combination of search terms, which facilitated the refinement of the obtained results. By using specific combinations of keywords, it was possible to cover a broader spectrum of relevant publications while excluding those that did not directly address the research objectives.

The selection and filtering process of the identified studies followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram (Figure 1). This structured approach ensures transparency and reproducibility in the analysis, providing a framework to document each stage, from identifying studies to their final inclusion in the analysis. The following figure shows the different phases of the process, including the number of studies identified, filtered, and excluded at each stage (Moher et al., 2010).

To define the corpus of reviewed studies, inclusion and exclusion criteria were established. The selected articles had to be published in indexed journals, include empirical analyses on the topic of interest, and be written in English or Spanish. Editorial studies, reviews lacking a robust methodological framework, and publications prior to 2014 were excluded. Initially, the search results yielded a total of 188 articles, of which 33 were removed due to duplicates generated by searches in the Scopus and Web of Science databases. Subsequently, 58 articles were excluded for lacking a strong connection to the analysis of formative assessment. Of the remaining 97 articles, 31 were discarded as they could not be retrieved from the source. Finally, of the 66 articles selected for eligibility, 30 were excluded for not focusing on graduate students, and 17 for concentrating on specialization studies in the medical field. The final result was 19 eligible articles to conduct the systematic literature review. These criteria ensured that only the most recent and relevant studies were considered to address the research questions (Moher et al., 2010).



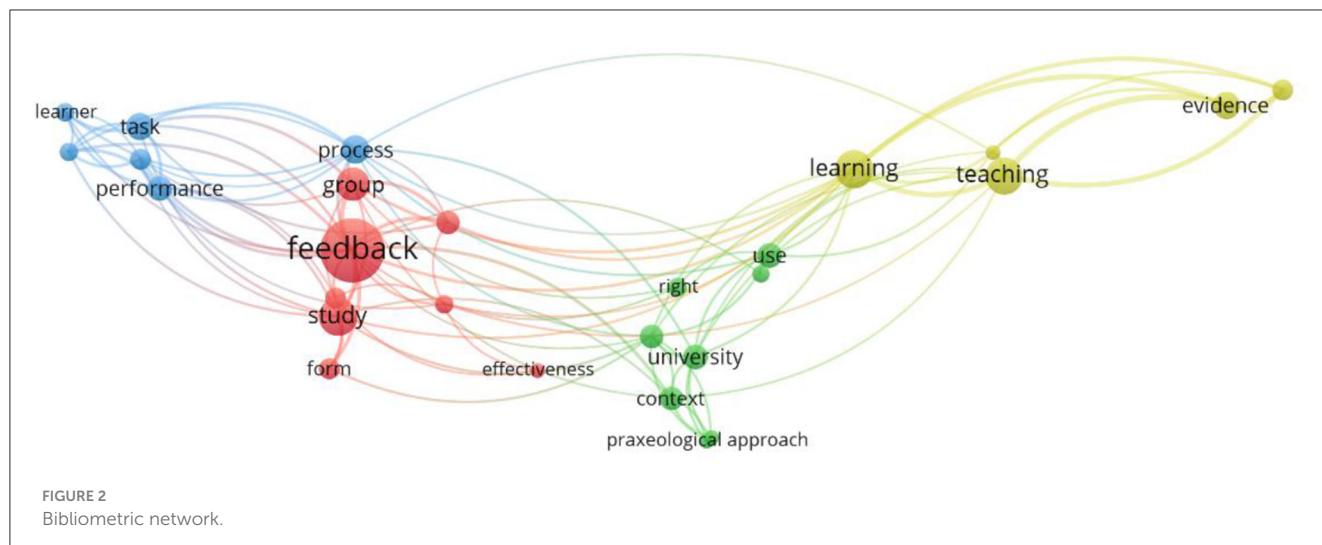
The research questions played a crucial role in guiding the systematic review process. These questions were designed to clearly and precisely address the central aspects of the investigated topic, serving as a guide for identifying and selecting the most relevant studies. The research questions were formulated based on the authors' criteria, taking into account the relevance of each topic addressed in the study. They were structured to facilitate an in-depth analysis of the existing literature, enabling the identification of patterns, knowledge gaps, and potential areas for future research. The following research questions guided this study: (1) What topics have been addressed in the reviewed articles over the past 10 years?; (2) What are graduate students' perceptions of feedback?; (3) What is the impact on academic engagement?; (4) What teaching practices influence the perception of feedback?; (5) What innovations have been seen in formative assessment among students?; (6) What is the influence of FA on students' learning achievements or competencies?

The result of the SLR process can be found at the following link: <https://doi.org/10.5281/zenodo.13918325>.

4 Results

4.1 How have the topics been addressed in the articles over the past 10 years?

Figure 2 was processed and analyzed using VOSviewer version 1.6.20, a software tool designed to visualize and process large volumes of information for bibliometric analysis (Bich et al., 2024). The figure represents a network of term co-occurrences, highlighting "feedback" as a central concept connected to various aspects of the teaching and learning process. The first cluster, in red, can be interpreted as "Feedback and Learning Processes" since it connects feedback with tasks, groups, performance, and learning processes, suggesting its importance in academic progress. The second cluster, in green, "Use of Feedback in University Contexts," emphasizes how feedback is implemented in university settings with a praxeological approach. The third cluster, in blue, "Performance and Task Evaluation," focuses on the relationship between student performance and assigned tasks. Finally, the fourth cluster, in yellow, "Evidence-Based Teaching and Learning,"



reflects how teaching and learning are grounded in empirical evidence. Together, the figure shows how feedback is key to learning, impacting both individual performance and evidence-based pedagogical practices.

4.2 What are the perceptions of graduate students toward feedback in formative assessment?

Regarding graduate students' perceptions of feedback in formal education, there is general consensus about its crucial importance for students' academic development and continuous improvement. Talib et al. (2015) highlight that meaningful and specific feedback is one of the most valued aspects, as it allows students to restructure their knowledge and meet the expected standards in higher education. This focus on specificity is fundamental, as clear and targeted feedback fosters not only understanding but also the student's ability to apply concrete improvements. This idea is complemented by the findings of Dickson et al. (2019), who point out that students participating in peer feedback exercises, where continuous and detailed feedback was received, significantly improved their academic performance. They emphasize that feedback not only facilitates knowledge acquisition but also boosts confidence in future evaluations.

Moreover, the format of the feedback also plays a key role in students' perception. According to Talib et al. (2015), most students prefer to receive a combination of verbal and written feedback, as they consider that both modalities offer a more comprehensive view of their areas for improvement. This finding aligns with the observations of Coll et al. (2014), who remark that feedback provided by teachers should address both content aspects and academic and social participation, as these dimensions are deeply interrelated in online collaborative learning environments. This type of feedback, which goes beyond content, is perceived as more enriching by students, as it allows them to understand not only what they need to improve but also how they should actively engage in the learning process.

Another crucial aspect is timeliness, that is, the promptness with which feedback is provided. Both Talib et al. and Lee et al. emphasize that students value receiving timely feedback, which allows them to make adjustments before it is too late in the course. In fact, in situations where students received late feedback, they expressed frustration over not being able to implement the suggestions in future assignments (Lee et al., 2022; Talib et al., 2015). This perception that time is a crucial factor in feedback resonates with the research by Zheng et al. (2024), who identify that automated feedback through AI-assisted platforms can complement human feedback by providing immediate feedback, although it cannot yet fully replace the social interaction that students find valuable in peer feedback.

In general, students see feedback as an essential part of their learning process, particularly when it is timely, specific, and presented in multiple formats. This feedback not only improves their academic performance but also increases their confidence and reduces anxiety about future assessments, as demonstrated by Dickson et al. (2019) and Talib et al. (2015), who agree that continuous and well-structured feedback fosters a more inclusive and effective learning environment. This body of studies reinforces the idea that the quality of feedback directly impacts students' perception of their academic progress, making feedback an indispensable tool in graduate education.

4.3 What is the impact of feedback on academic engagement?

The impact of feedback on the academic engagement of graduate students has been explored from various perspectives, showing how the quality and nature of feedback directly influence the level of student engagement in their own learning process. A study by Zheng et al. (2024) indicates that automated and peer feedback increases engagement, as students not only receive information about their performance but are also motivated to improve continuously through a cycle of evaluation and self-assessment. This approach enables students to stay more connected

with their learning, contributing to greater engagement as they see their efforts translate into tangible improvements.

On the other hand, Coll et al. (2014)'s study on feedback in collaborative learning environments shows that students' engagement increases when feedback also covers aspects of social and academic participation. By receiving feedback on their participation in group activities, students feel more motivated to actively engage in discussions and projects, enhancing their sense of shared responsibility and belonging to the group. This is particularly relevant in online learning contexts, where social interaction can be challenging, but when integrated with appropriate feedback, students show a higher level of engagement.

Similarly, studies such as Dickson et al. (2019) highlight that formative feedback, whether from peers or teachers, has a direct effect on students' confidence, which in turn reinforces their academic engagement. Students who receive consistent and constructive feedback not only improve their performance but also develop a sense of self-efficacy that drives them to engage more deeply in academic tasks. This finding is supported by Raković et al. (2023), who in their research on the use of data and linguistic analysis to predict student performance, argue that feedback should focus not only on the final product but also on the cognitive and metacognitive processes students use during task development. By receiving feedback on these processes, students not only feel more engaged with the current task but also develop transferable skills for future academic projects.

Finally, Mohammed (2021) point out that the use of self-assessment and peer assessment can also positively impact academic engagement, especially in environments where students are responsible for their own progress. This type of assessment fosters a sense of autonomy, which increases intrinsic motivation and, consequently, overall engagement with the learning process. In this sense, feedback is not just a corrective tool but a mechanism that drives continuous engagement by involving students in an active cycle of self-assessment and constant improvement.

Together, these studies demonstrate that feedback has a substantial impact on academic engagement, as it not only improves students' direct performance but also strengthens their motivation, self-efficacy, and sense of belonging within the academic environment. When feedback is timely, specific, and multifaceted, students feel more engaged in their own learning, leading to greater academic commitment.

4.4 What teaching practices influence the perception of feedback in formative assessment?

The teaching practices that influence the perception of feedback in formal education are varied, and their effectiveness largely depends on how feedback processes are managed. Feller and Berendonk (2020) highlight that a key practice is the combination of formative and summative feedback, where teachers not only correct students' work but also provide comments that help students improve in future tasks. This perspective aligns with the findings of Dickson et al. (2019), who emphasize that formative feedback, when given in a timely manner, not only improves

performance but also reinforces the positive perception of feedback as a tool for continuous learning.

Henderson and Phillips (2015) underscore the importance of clarity and specificity in feedback. This finding is supported by Talib et al. (2015), who point out that students value feedback that is clear, specific, and directly applicable to their academic work. When comments are vague or general, students tend to perceive feedback as less useful, which affects their engagement in the improvement process. In this sense, both clarity and specificity in teachers' comments are key factors influencing how students receive and apply feedback.

The use of educational technology has also been identified as a teaching practice that improves the perception of feedback. Jadon et al. (2022) found that digital platforms allowing students to review their comments at any time encourage deeper reflection and promote more effective use of feedback. This finding is consistent with what Coll et al. (2014) reported, who argue that the use of technological tools facilitates constant interaction between students and teachers, improving the perception that feedback is accessible and useful. Additionally, Raković et al. (2023) highlight that digital tools allow teachers to provide feedback not only on the final product but also on the cognitive processes involved, offering students a more holistic understanding of their learning.

Collaborative feedback is another teaching practice that positively influences the perception of feedback. According to Kalaitzopoulou et al. (2023), when teachers promote peer evaluation in a collaborative environment, students tend to value feedback more, as they are actively involved in creating evaluation criteria and in the learning process of their peers. This approach is supported by studies by Jiménez et al., who found that students participating in such activities have a greater understanding of feedback, improving their perception of its usefulness (Jiménez Moreno et al., 2022; Kalaitzopoulou et al., 2023). Well-managed collaborative feedback allows students not only to receive but also to generate valuable comments, increasing their engagement and satisfaction with the process.

Finally, Woods et al. (2023) suggest that practical and contextual feedback is key for students in applied learning environments, such as in the teaching of clinical skills. When students can see how feedback directly translates into practical and applicable improvements, they perceive it as more valuable and relevant. This finding aligns with what Feller and Berendonk (2020) and Mohammed (2021) noted, who conclude that students receiving feedback directly related to the practical application of their skills tend to value it more, as they consider it essential for their professional development.

4.5 What innovations have been seen in formative assessment among students?

In recent years, several innovations in formal education have transformed the way students interact with learning and feedback. One of the most notable innovations is the use of AI-assisted automated assessment platforms, as described by Zheng et al. (2024) these platforms offer immediate and detailed feedback on specific skills, such as language and writing

proficiency, allowing students to improve autonomously without waiting for teacher intervention. This type of automated feedback complements traditional assessment, providing more continuous and personalized support, resulting in greater student engagement. Henderson and Phillips (2015) also support this approach, noting that automation in feedback facilitates self-assessment, a skill increasingly necessary in autonomous learning environments.

Another important innovation is the integration of collaborative technologies that promote peer learning, as observed in the study by Kalaitzopoulou et al. (2023). These tools allow students to receive feedback not only from their teachers but also from their peers, enhancing collective learning. The use of platforms like online forums and co-editing tools has increased student interaction, improving the quality of feedback and fostering an environment where learning is a shared experience. Jadon et al. (2022) reinforce this idea, pointing out that collaborative platforms not only help improve the perception of feedback but also allow students to develop critical evaluation and reflection skills, strengthening their capacity for self-regulation in learning.

Finally, personalized learning through data analysis has been a key innovation in formal education. According to Raković et al. (2023), the use of data analysis and behavior tracking allows teachers to adapt feedback to the individual needs of students, significantly improving academic performance. This approach enables students to receive feedback on their cognitive and metacognitive processes, which not only improves their immediate performance but also provides them with strategies for future learning. As Feller and Berendonk (2020) also emphasize, this use of data has allowed students to develop a greater understanding of their progress, facilitating more adaptive and efficient learning.

4.6 What is the influence of formative assessment on students' learning achievements or competencies?

Formative assessment has a crucial impact on the development of students' learning and competencies, mainly due to the continuous and specific feedback it provides. Raković et al. (2023) emphasize that formative assessment based on the analysis of cognitive and metacognitive processes allows students to adjust their learning strategies more effectively, resulting in a significant improvement in their academic competencies. This approach, which focuses on both the process and the product, coincides with what Jadon et al. (2022) mention about the importance of constant feedback for developing greater self-regulation in students. By combining feedback with self-assessment and critical reflection strategies, students achieve more sustainable improvements in their academic performance.

Moreover, Feller et al. and Kalaitzopoulou et al. (2023) agree that formative assessment not only reinforces academic learning but also fosters interpersonal and collaborative competencies, such as teamwork and effective communication. In environments where students receive feedback from peers and teachers, greater critical reflection and a deeper understanding of concepts are promoted. This collaborative approach aligns with what Jiménez Moreno et al. (2022) identified about the relevance of peer feedback, which enhances skills such as the ability to objectively evaluate the work

of others, in turn reinforcing the acquisition of cognitive and social competencies.

Finally, Woods et al. (2023) and Henderson and Phillips (2015) highlight how formative assessment also influences the development of practical and transferable competencies, such as problem-solving and decision-making. Feedback focused on the practical application of knowledge, as in the case of the clinical skills studied by Woods et al. (2023), allows students to transfer their learning to real-world contexts more effectively. This approach is complemented by Henderson and Phillips (2015), who argue that formative assessment encourages students to apply feedback not only in the academic realm but also in workplace or professional situations, ensuring the comprehensive development of their competencies.

5 Discussion

Feedback is a key driver of academic self-regulation in graduate students, enhancing their ability to manage their own learning. This study confirms that students who receive continuous feedback demonstrate significant improvements in planning, monitoring, and evaluating their progress, aligning with the self-regulated learning theory (Lee et al., 2022; Panadero, 2017). These findings suggest that specific and timely feedback acts as a catalyst for developing metacognitive skills, enabling students to approach their learning with greater autonomy. However, variability in how feedback is delivered across different programs and disciplines highlights the need for more standardized practices that ensure consistent effectiveness across contexts.

Immediate feedback has a direct and transformative impact on increasing motivation and academic engagement among graduate students. The analyzed studies consistently associate timely and specific feedback with higher levels of student participation and active involvement in academic tasks. Research by Hattie and Timperley (2007) and Feller and Berendonk (2020) supports the notion that immediate feedback fosters intrinsic motivation and a stronger sense of responsibility in learning. Additionally, the integration of immediate feedback into collaborative environments, as demonstrated in online and hybrid settings, enhances not only individual engagement but also collective accountability among peers. Nonetheless, challenges persist in maintaining the balance between immediacy and depth of feedback, particularly in large-scale graduate programs where resource limitations can hinder personalized interactions.

Personalized feedback is essential to maximizing learning in graduate settings. Various studies agree that personalized feedback significantly improves students' academic performance by adapting to their individual needs and learning styles. This assertion is supported by the theory of differentiated learning, which posits that tailoring feedback to student characteristics fosters more effective and autonomous progress (Henderson and Phillips, 2015; Zheng et al., 2024). Personalized feedback not only optimizes learning but also promotes greater equity by addressing individual differences among students.

Technology has transformed the way feedback is implemented in the educational sphere, providing more efficient and accessible tools. The use of digital platforms and automated tools has facilitated the delivery of immediate feedback, improving the

interaction between students and teachers and speeding up the process by which students receive comments on their performance. This approach is supported by the theory of technology-mediated learning, which suggests that digital tools not only accelerate processes but also allow for greater personalization and monitoring (Andriamiseza et al., 2023; Varlakova et al., 2022). Therefore, the integration of technology in feedback fosters more dynamic, accessible, and tailored learning to meet the individual needs of students.

Finally, although formative evaluation can present notable benefits, it is relevant to consider each student characteristics, especially when additional formative assessments are required to implement to foster the effects, because for student who have a high self-regulation capacity the incremental contribution of the formative assessment will provide the opportunity for a much deeper input in learning due to feedback and positive reinforcement. Nevertheless, for students who do not invest time and effort, the lack of a positive impact may be related to a low motivation or a perception of difficulty in assigned tasks (Borter, 2024).

On the other side, by adapting the formative assessment strategies according to each student needs can ensure a deeper and more meaningful learning. In this regard, this type of assessment is fundamental to develop high-order cognitive skills such as self-regulation and critical thinking in postgraduate students (Sabale et al., 2022).

6 Conclusion

In summary, this systematic review has demonstrated that formative feedback plays a crucial role in graduate education, enhancing both students' learning and academic engagement. (a) The results indicate that immediate and personalized feedback is essential for promoting student self-regulation, enabling more autonomous and sustained learning. (b) Additionally, the use of technology has optimized the way feedback is provided, increasing its effectiveness and accessibility. (c) Finally, the implementation of feedback strategies that consider the individual needs of students contributes to equity in the educational process, ensuring that all students have opportunities to improve their academic performance.

Although exhaustive in its analysis, this study presents some important limitations. First, the review was based exclusively on studies published in academic databases, which may have excluded relevant research that is not indexed or published in other formats. Additionally, the heterogeneity of the reviewed studies in terms of methodologies and educational contexts made it difficult to directly compare results, limiting the ability to generalize the conclusions to all graduate programs. Lastly, many studies did not provide detailed data on the long-term impact of formative

feedback, leaving a gap in understanding its lasting effects on student learning.

Future research should address several areas that were not sufficiently explored in this review. First, longitudinal studies are needed to examine the long-term effects of formative feedback on motivation and academic performance. Additionally, it is recommended to explore the impact of personalized feedback in multicultural and diverse contexts to identify which strategies work best in different environments. Finally, further research should investigate the role of emerging technologies, such as artificial intelligence, in formative feedback to evaluate their potential in personalizing and automating learning.

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Students' perceptions and outcome of teacher feedback: a systematic review

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This systematic review examines students' perceptions and outcomes of teacher feedback in elementary and lower secondary education (ages 10–16). The study explores how different feedback types and personal and relational factors influence students' achievement and their cognitive, emotional, and behavioral outcomes. Following PRISMA guidelines and the PICO framework, 96 empirical studies were analyzed, focusing on feedback-related student outcomes and moderating factors. Findings indicate that high-quality, tailored, and action-oriented feedback positively affects student achievement, motivation, and engagement, while negative or vague feedback can lead to demotivation and avoidance behaviors. Students prefer direct and individualized feedback, and trust in the teacher-student relationship is crucial for effective feedback uptake. Social dynamics, gender differences, and feedback interpretation influence student outcomes, emphasizing the need for adaptive feedback strategies. The review suggests that future research should focus on finding specialities and commonalities across various groups as well as on integrating AI with human feedback systems.

KEYWORDS

student assessment, teacher feedback, feedback outcome, feedback moderators, student perspective, systematic review

1 Introduction

1.1 The purpose of this review

Formative assessment in elementary and lower secondary schools is challenging for both students and teachers. It requires processes that integrate received feedback and enhance the learning experience (Black and Wiliam, 1998; Gamlem and Smith, 2013; Van der Kleij, 2022). Formative feedback is information aimed at modifying the learner's thinking or behavior to improve learning (Shute, 2008). While feedback significantly influences achievement, its effects can vary, highlighting the complexity of its optimal use (Hattie, 2009; Shute, 2008). Shute (2008) identifies various feedback types (e.g., correct answer explanations, hints), modalities (e.g., written, oral), and timings (e.g., during learning, immediately after a response). Additionally, variables like learner characteristics and task aspects interact with feedback's effectiveness. Wisniewski et al. (2020) found that high-information feedback, including self-regulation information, is most effective ($d = 0.99$).

Traditionally, teachers were solely responsible for providing evaluative feedback (Hattie and Timperley, 2007; Shute, 2008). However, the paradigm has shifted to recognize the social context of learning, where students actively seek, receive, and apply feedback (Gamlem and Smith, 2013; Lipnevich and Panadero, 2021; Van der Kleij, 2022). Van der Kleij (2022) advocates for a student-centered approach, giving students agency. Feedback is

a dynamic interaction between teacher and student aimed at facilitating learning (Andrade, 2010; Gamlem and Munthe, 2014), but it is effective only when used.

To understand how feedback impacts learning, it is essential to study the relationships among teacher feedback, student beliefs, motivation, interpretation, and responses (Yang et al., 2021). It is still unclear what kind of teacher feedback is most beneficial and what moderating factors enhance learning. This study systematically reviews empirical research on students' perceptions and outcomes related to teacher feedback for ages 10–16.

1.2 Feedback in elementary and lower secondary school

Teacher feedback is vital but insufficient without student engagement (Van der Kleij, 2022). Understanding students' perspectives is crucial to grasp how feedback is received, interpreted, and used. This approach helps identify what types of feedback work best and why (Shute, 2008). Including students' views makes research more democratic and relevant (Fielding, 2004).

We focus on students aged 10–16, a period of significant cognitive, emotional, and social development (Eccles et al., 1993). Feedback during this transitional phase from primary to secondary school is critical for adapting to new learning environments and expectations (Black and Wiliam, 1998). Understanding students' feedback perceptions can guide effective interventions to boost learning and engagement (Wigfield and Eccles, 2000). Effective feedback usually answers three questions: Where am I going? How am I going? Where do I go next? It operates at four levels: task, process, self-regulation, and self (Hattie and Timperley, 2007).

Despite its potential, feedback often fails to enhance learning (Shute, 2008). Effective feedback should be part of the teaching process, be comprehensible, be actionable, and stimulate critical thinking (Andrade, 2010; Black and Wiliam, 2018; Hattie and Gan, 2011). It should align with learning objectives (Hattie and Timperley, 2007; Gamlem and Munthe, 2014). However, not all feedback types are beneficial. Evaluative feedback like scores and rewards can hinder learning (Guskey and Brookhart, 2019; Kluger and DeNisi, 1996). Grades and scores can decrease crucial metacognitive strategies (Boekaerts and Corno, 2005). Volitional engagement is essential for persistence and managing self-esteem threats (Black and Wiliam, 2009; Boekaerts and Corno, 2005). Moreover, former research found that feedback effects vary among students, indicating diverse feedback needs (e.g., Shute, 2008; Lipnevich et al., 2016). Feedback interpretation and response involve psychological states and dispositions (Butler and Winne, 1995; Perrenoud, 1998). Prior knowledge, beliefs, and thought processes mediate feedback effectiveness (Smith et al., 2016). For feedback to be effective, it must be processed through the learner's unique cognitive lens.

1.3 The present study

In this study, we attempt to fill a gap in the assessment literature by systematically reviewing empirical research on feedback in the

age group 10–16. This is based on the fact that most feedback research has been done on students in higher education and the need to systemize research on younger students. Furthermore, because we are particularly interested in what works for students, we have focused on student outcomes. Related to this is also an interest in what causes or influences student outcomes, which we have chosen to name moderators.

Much of the research and theory development in the formative assessment field has occurred over the past 25, and because we wanted to avoid being history-less and forgetting good research that goes back a bit in time, we chose the last 30 years as the search period. Since we started the work on this review in 2021, it includes articles dating back to December 1991. Furthermore, as we did not know how artificial intelligence would influence feedback processes and, consequently, the research related to feedback, we decided to end the review when ChatGPT launched in November 2022.

Given this point of departure, the following research questions have guided the review.

1. What student outcomes are measured in studies concerning teacher feedback?
2. What factors are assumed to moderate students' outcomes of teacher feedback?
3. Do the results of the studies indicate that some factors are more important than others in moderating students' various outcomes of teacher feedback?

2 Method

In this review, we followed the PRISMA guidelines and the PICO framework as far as applicable. This means that we followed the PRISMA guidelines as our primary framework for reporting. Additionally, we used the PICO framework to assess each included study, focusing on population, intervention/measure, type of comparison, and outcome. However, since this review goes beyond strictly defined interventions and includes observational and small-scale qualitative studies, the comparison component (C) and outcome components (O) of the PICO framework were not always applicable. The literature search was conducted in two rounds in the databases Eric, PsychINFO, Educational Research Complete, and Scopus, resulting in a total of 8,593 hits that went on to the title and abstract screening. The first search contained studies from December 1991 until December 2021. Later, an updated search was made for the period up to November 2022, which is the time when ChatGPT was made generally available.

In developing the search protocol, key areas of teacher feedback were identified and categorized. These areas included *teacher feedback itself*, encompassing different feedback types (e.g., achievement feedback, performance feedback) and processes in which feedback occurs (e.g., formative assessment, assessment for learning). Another key area was *students' perceptions of feedback*, which covered general perception terms as well as cognitive and emotional responses. Additionally, the *outcomes of teacher feedback* were considered, including improvements in knowledge and changes in various beliefs, changes in motivation, behavioral changes or regulation of learning, and various achievement descriptors. Lastly, possible *moderating variables of teacher feedback* were identified, incorporating feedback content and types,

task requirements, feedback mode, feedback context, individual differences, and social relation variables. Altogether, this process resulted in 138 descriptors. In the next phase, we were supported by a librarian at the Medical Library at the University of Oslo to specify and conduct the first trial search, which we scrutinized regarding the relevance of the hits, and then a final search. Further, the search criteria required that articles (a) should relate to education, (b) be published in English, (c) be peer-reviewed, and (d) for empirical studies include data from or about students (search documentation is available in the [Supplementary material](#)).

The authors and three trained research assistants used the Covidence software for the title and abstract screening. Two blinded independent reviewers had to agree on all decisions on whether the study should be included. However, some conflicts arose due to the great diversity in both content and methodological approaches and the clarity of the abstracts. These conflicts were solved through an extra round of review and discussions that included one or both authors. Inclusion criteria were “educational context, teacher feedback, feedback given through digital media by a teacher, student outcome, student achievement (tests, performance), cognitive outcome (e.g., learning, understanding, beliefs), motivational outcome (e.g., change in goals, student engagement), relational or social outcome, judgment of feedback, students’ perceptions and reactions on feedback”. Exclusion criteria were “lack of students’ perspectives, empirical studies that do not include data from or on students, studies do not include student outcome, feedback was not given by a teacher, and computer-generated feedback.” The title and abstract screening resulted in 1,501 records proceeding to the full-text review.

Through the long process of title and abstract screening, we realized the need to narrow the present study’s focus. This was based on the interest in producing manageable data material. Therefore, we changed the inclusion and exclusion criteria before starting the full-text review. The narrowing involved only including empirical studies and focusing only on studies that examined the age group 10–16. The last criterion emerged after recognizing that we lack systematized knowledge about this age group. The two authors and one trained research assistant conducted the full-text review. Furthermore, we used the procedures previously described to resolve conflicts. The full-text screening resulted in 100 included records. However, four more records were excluded during the extraction process because it became clear that the feedback was not given by a teacher, or the sample exceeded the defined age range (see [Figure 1](#) for the PRISMA flow diagram).

2.1 Extraction, coding and presentation

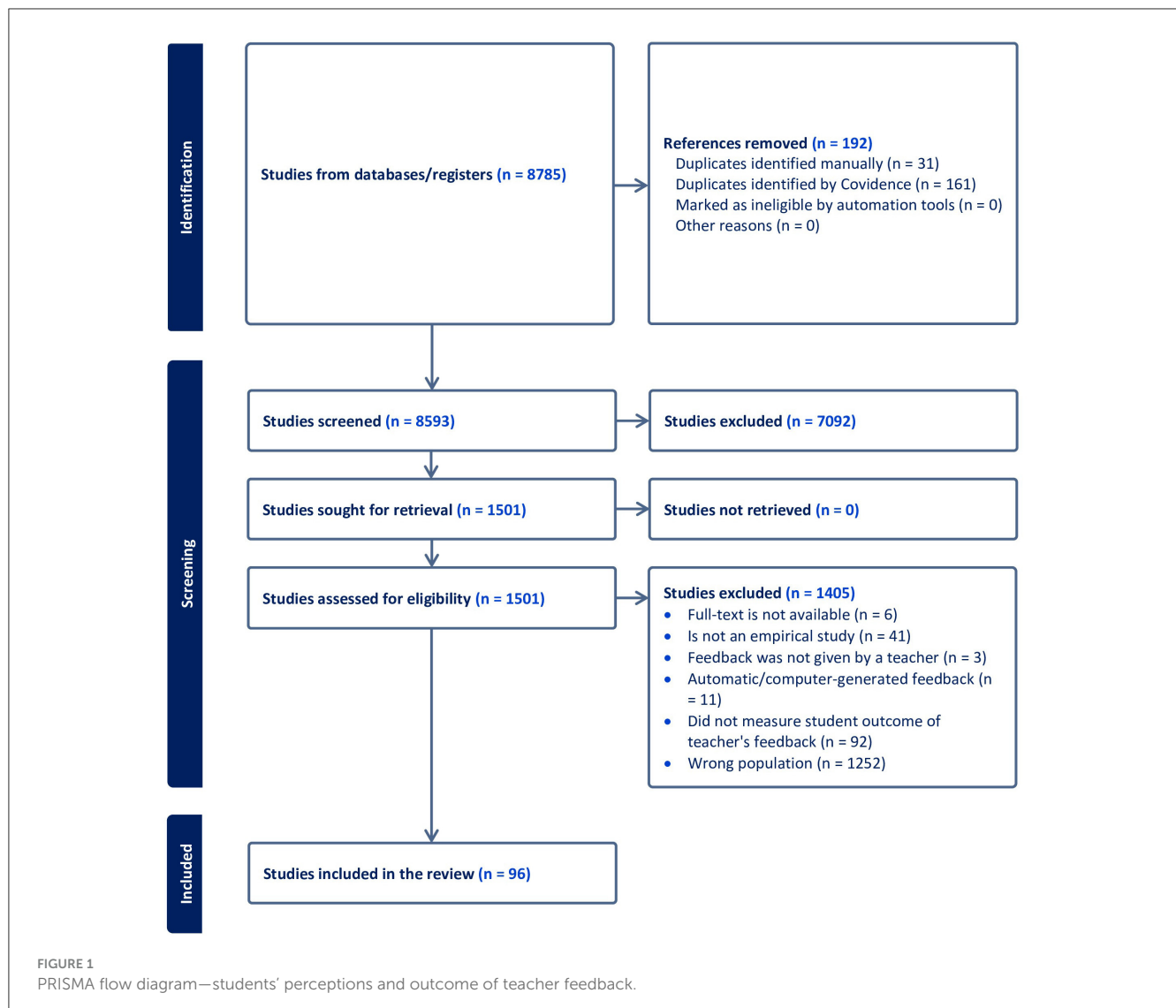
All key information about the studies was gathered in a spreadsheet in the extraction phase. We used the Data Analyst function in ChatGPT to extract the most significant information from each study. A PDF file of each article was uploaded to the service, after which we provided prompts to extract information. Typical prompts were “...given an overview of the study, ...what study design was used, ... main findings concerning

feedback”. The information was then manually coded into four main outcome categories (achievement, cognitive, emotional, and behavioral outcome), which are based on common categories from educational psychology. In addition, we coded potential moderators or causes related to the outcome (feedback mode and type, task-related, personal factors, relational factors, and contextual factors). It should be mentioned that each main category had several subcodes to ensure consistency in coding. The cognitive category was clearly the largest because it contained almost all types of motivation, perceptions, and beliefs. The emotional category was clearly the smallest because it was reserved for more purely emotional outcomes.

It should be noted that several terms are used to represent students’ academic engagement. This is because the included studies differ in descriptions, conceptualization, and grain sizes regarding the operationalization of student engagement. As a point of departure, we consider student engagement a multidimensional construct containing cognitive, emotional and behavioral aspects ([Fredricks, 2011](#); [Sinatra et al., 2015](#)). From our perspective, cognitive engagement refers to psychological investment when a student uses cognitive effort beyond the minimal requirements to understand a subject matter, use flexible problem-solving or choose a challenging task ([Sinatra et al., 2015](#)). Emotional engagement refers to students’ reactions to academic activities, such as enjoyment related to tasks, that can lead to high engagement and attention ([Pekrun and Linnenbrink-Garcia, 2012](#); [Sinatra et al., 2015](#)). Behavioral engagement refers to actions such as attendance and participation in academic activities and includes effort, persistence and overt parts of self-regulation and the use of learning strategies ([Fredricks, 2011](#); [Sinatra et al., 2015](#)). In our presentation of the studies, we have adhered to the terminology used in the original papers. When the type of engagement is not explicitly stated, we have used the general term engagement and categorized it based on contextual information within the respective study. Additionally, we use the term “student engagement” as an overarching term in our discussion ([Marks, 2000](#)).

It should also be noted that not all the included studies had clear moderators or causes for specific outcomes. Some studies were primarily descriptive and did not define causes or outcomes. We also analyzed these studies and tried to extract key insights and conclusions that could contribute to the discussion of the current study’s topics. We have nevertheless chosen to retain moderators and outcomes as the main categories in our presentation, as this has been fundamental in the thinking throughout the work with the study.

In presenting our results, we distinguish between interventions, observational studies, and small-scale qualitative studies, building on the rationale that these represent different forms of evidence. Intervention studies offer strong insights into causality, while observational studies, though weaker in establishing causality, can help identify relevant variables, correlations and trends over time ([Shadish et al., 2002](#); [Rosenberg, 2020](#)). Qualitative studies can better understand complex phenomena and subjective experiences ([Carey, 2012](#)). Even though the quality of the studies may vary within these categories, we have treated them rather uniformly, acknowledging this approach’s limitations. Finally, we



have marked the studies included in the review (*) in the reference list.

3 Results

3.1 Teacher feedback and student achievement

3.1.1 Teacher feedback and student achievement in intervention studies

In total, 17 intervention studies included one or more measurements of student achievement (see Table 1). For most of these studies, the manipulation (moderator) was related to the feedback per se and with variation in form, content, or both. Further, twelve of these studies report a positive effect on student achievement, four report no effect, and one report a mixed effect. Several studies that report a positive impact emphasize the content quality of the feedback given. This might

be more comprehensive or explicit information about the task, task criteria, learning goals and advice on possible strategies to enhance the learning process (Al-Darei and Ahmed, 2022; Eckes and Wilde, 2019; Ozan and Kincal, 2018; Ruiz-Primo and Furtak, 2007; Siero and van Oudenhoven, 1995). One study also included a kind of student activation as part of the feedback process (Ruiz-Primo and Furtak, 2007). This can take the form of the students having to decide on and process their feedback, either as an explicit assignment or as a task solved together with peers. Another highlighted dimension is the opportunity to discuss and elaborate on the feedback with the teacher (Mikume and Oyoo, 2010), which can scaffold the students' understanding of both the feedback and the requirements of the learning task.

Several studies emphasize process-oriented feedback, but the findings regarding such feedback's influence on achievement are inconsistent. Process-oriented feedback with a clear message about strategies or how or where to go next is positively associated with achievement (Schunk and Rice, 1991, 1993). In

TABLE 1 Overview of the included invention studies that relate teacher feedback with student achievement.

Record	Reference	Country	Sample	Design	Effect on achievement	Improved quality of FB information	Activation of students in processing feedback	Dialogue with teacher	Process-oriented feedback—how to do	Process-oriented feedback- value and goal	Process-oriented with unspecified focus	Focus on correcting errors	Integrating technology	Adapted to students' special needs	Augmented feedback for motor skills learning
3	Al-Darei and Ahmed (2022)	Oman	97 (age 13–14)	A quasi-experimental design with three groups	+	↙									
11	Chan and Lam (2010)	Hong Kong	79 from grad eighth 77 grade sevens	Randomized controlled trial design	⊗						↙				
12	Chang et al. (2020)	Taiwan	51 fifth graders	Quasi-experimental Design.	+								↙		
19	Eckes and Wilde (2019)	Germany	165 students (age 12)	This is a quasi-experimental pretest-post-test study	+	↙									
44	Lee et al. (2022)	Taiwan	41 male students (age 15–16)	Quasi-experimental Research Design	+										↙
51	McLaughlin (1992)	USA	5 behaviorally disordered students (age 10–11)	Quasi-experimental design	+									↙	
52	Mikume and Oyoo (2010)	Tanzania	29 students (age 15–16)	The study used an action research model.	+	↙	↙	↙							
58	Ozan and Kincal (2018)	Turkey	45 fifth graders	A quasi-experimental design with pre-post-test and control group	+	↙									
60	Pinger et al. (2018)	Germany	426 ninth-grade students (age 15) 17 Teachers	Quasi-experimental design (intervention).	+					↙					
61	Rakoczy et al. (2019)	Germany	620 students (age 15), 26 teachers	Intervention study with control group	⊗				↙						

(Continued)

TABLE 1 (Continued)

Record	Reference	Country	Sample	Design	Effect on achievement	Improved quality of FB information	Activation of students in processing feedback	Dialogue with teacher	Process-oriented feedback—how to do	Process-oriented feedback- value and goal	Process-oriented with unspecified focus	Focus on correcting errors	Integrating technology	Adapted to students' special needs	Augmented feedback for motor skills learning
64	Ruiz-Primo and Furtak (2007)	USA	25 students from grades 6 and 7 and 12 teachers	Intervention without any control group—mixed-methods approach	+	↙	↙								
68	Santanatanon and Chinokul (2022)	Thailand	26 tenth graders from an all-girls school	The study used a mixed-method experimental design	⊗							↙			
69	Schunk and Rice (1991)	USA	30 fifth graders (age 10–14)	Randomized controlled trial design	+				↙						
70	Schunk and Rice (1993)	USA	44 students (age 10–11)	Randomized controlled trial design	+				↙	↙					
73	Siero and van Oudenhoven (1995)	The Netherlands	296 fifth graders (age 10–11)	Randomized controlled trial design	+	↙									
92	Wiggins et al. (2017)	England	Approx. 6,500 pupils form 97 schools (age 9–11)	Randomized controlled trial design	⊗								↙		
97	Yeager et al. (2014)	USA	44 seventh graders in studies 1 and 2. 76 tenth graders in study3	Randomized field	+									↙	

addition, process-oriented feedback highlighting the utility of strategy use and process goals appears to influence achievement positively (Pinger et al., 2018; Schunk and Rice, 1993). However, some studies that emphasize process-oriented feedback do not find such effects. In a study where students received feedback encouraging them to make effort and self-improvement (Chan and Lam, 2010), a positive effect was seen on students' motivation and control beliefs but not on achievement. In another study made in the context of a mathematics class, the teachers did almost all the measures recommended by the assessment literature; the feedback was individualized, weaknesses and points of improvement were identified, recommendations on strategies were given, and the learning goals were highlighted (Rakoczy et al., 2019). Still, they only gained an effect on motivational variables.

A discussion related to corrective feedback is about balancing pointing out errors and recommending how to avoid such mistakes in future work. In one study conducted in the context of English language learning, the students received detailed written grammar feedback in the form of error codes and corrected sentences, but the researchers could not find any improvement in students' achievement despite increased student engagement (Santanatonon and Chinokul, 2022).

Two of the included studies explored new technology in the process of teacher feedback. In one study conducted in the context of a virtual reality design (in natural science), students who took part in a virtual reality design activity incorporating a peer assessment learning approach showed significantly better achievements in natural science than those using a conventional VR design system (Chang et al., 2020). The conventional VR design group received teacher-centered feedback to guide students in improving their VR projects and achieving better learning outcomes. In another study, an electronic handheld device that allowed teachers and pupils to provide immediate feedback during lessons was tested in 49 primary schools across several subjects (Wiggins et al., 2017). Even though both students and teachers had largely positive experiences with the system, there were no improvements in mathematics or reading performance compared to the control schools.

Two of the studies examined the effect of teacher feedback on students with learning challenges. One study on behaviorally disordered children found that positive written comments tailored to their performance and effort during reading tasks positively affected their reading accuracy in the short and long term (McLaughlin, 1992). Another study examined adapted feedback to students who had low trust in school and teachers (Yeager et al., 2014). The form of feedback they gave, named "wise feedback", reflected criticism paired with the teacher's high standards and belief in the student's potential to meet those standards. The students who received the "wise feedback" improved their performance on essay writing and revising as well as their general academic outcome compared to the control group. Finally, one study examined teacher feedback in a vocational setting. This study found that augmented teacher feedback combined with self-estimation of errors (enforced metacognitive reflection) improved students' motor skill learning and the quality of their final welding product (Lee et al., 2022).

3.1.2 Teacher feedback and student achievement in observational studies

Eleven studies used observational designs to examine teachers' feedback's relation to student achievement (see Table 2). Three of these studies were based on secondary analyzes of PISA data¹ (Cunha et al., 2019; Hu and Wang, 2022; Rohatgi et al., 2022) on 258,196 students from more than 30 countries. Furthermore, these studies consistently found a negative relationship between the teacher feedback reported by students and their achievement in science on the PISA 2015 assessment and reading on the PISA 2018 assessment. This negative association can probably be explained by the PISA items' response scale asking how often the student receives various forms of teacher feedback and that students with lower competence receive feedback more frequently than high-achieving students (Rohatgi et al., 2022).

Four studies explore teacher feedback related to homework, and their findings are pretty consistent (Cunha et al., 2019; Nunez et al., 2015; Tas et al., 2016; Xu et al., 2022). The more informative, accurate, meaningful, timely, and action-oriented the feedback is, the stronger associations are found with achievement in math (Cunha et al., 2019; Xu et al., 2022), science (Tas et al., 2016) and a collection of several subjects (Nunez et al., 2015). It should, however, be noted that several of these studies highlight student engagement as a mediating factor between feedback and achievement. If the homework feedback is clear and easily transferable into action, it supports students in engaging in the given tasks and assignments, which, in the next step, boosts their learning and performance.

However, two studies indicate that the clarity of feedback messages might be challenging. In one study where a determined system of written correcting feedback was implemented in English second language classes, most students improved their writing skills and motivation (Ganapathy et al., 2020a). However, a challenge was that some students did not always understand the feedback correctly; consequently, their performance suffered. Another study (Lui and Andrade, 2022) found that students with higher levels of achievement tended to make more constructive decisions about using the feedback they received. This included plans to reread feedback, review requirements, and make revisions, reflecting their engagement with the feedback process. These findings underscore that the perceived clarity of a feedback message can vary depending on students' individual differences, emphasizing the importance of adapting the feedback to each student's competence level to ensure it becomes meaningful and has an impact.

Finally, is there a balancing point regarding how comprehensive the feedback must be to affect students' learning and achievement? The answer, of course, would depend on many factors, such as the intention of the feedback, how the feedback is orchestrated, in which context, the mental state of the learner, etc. Two studies illustrate this complexity. In a descriptive study (Sewagegn and Dessie, 2020), the students reported that teachers often provided judgemental feedback (e.g., "excellent," "very good") or grades, which they found less effective in addressing specific learning gaps or guiding improvement. The feedback they found effective in improving their self-reported achievement was clear, specific, and constructive, highlighting learning gaps and

1 <https://www.oecd.org/en/about/programmes/pisa.html>

TABLE 2 Overview of the included observational and small-scale studies that relate teacher feedback with student achievement.

Record	Reference	Country	Sample	Design	FB association with achievement	PISA data	Homework FB: clear, informative, actionable	FB should be adopted to students' competence	FB content: clear, specific, actionable	Positive FB → behavior and academic outcome	Effects of direct vs. indirect feedback
Observational studies											
6	Bazán-Ramírez et al. (2022)	Peru	6,971 students (age 15)	Large scale Cross-sectional study	−	✓					
16	Cunha et al. (2019)	Portugal	4,288 sixth graders	Mixed methods sequential explanatory design	+		✓				
24	Ganapathy et al. (2020a)	Malaysia	482 students (age 16) and 15 teachers	Mixed methods convergence parallel design	+			✓			
33	Hu and Wang (2022)	29 OECD countries	223,807 students (age 15)	Large scale Cross-sectional study	−	✓					
47	Lui and Andrade (2022)	USA	93 seventh graders	Mixed-methods research design in a naturalistic classroom setting	+			✓			
56	Nunez et al. (2015)	Spain	454 students from three schools (ages from 10 to 16)	The cross-sectional survey	+		✓				
63	Rohatgi et al. (2022)	The five Nordic Countries	27,328 students (age 15)	Large scale Cross-sectional study	−	✓					
71	Scott and Gage (2020)	USA	Est. 27,000 students. (ages 10–16; 1,500 classrooms)	Large-scale study with multiple datatypes	+					✓	
72	Sewagegn and Dessie (2020)	Ethiopia	474 students from grades 5 to 8	Cross-sectional study, questionnaires and document reviews	+				✓		

(Continued)

TABLE 2 (Continued)

Record	Reference	Country	Sample	Design	FB association with achievement	PISA data	Homework FB: clear, informative, actionable	FB should be adopted to students' competence	FB content: clear, specific, actionable	Positive FB → behavior and academic outcome	Effects of direct vs. indirect feedback
82	Tas et al. (2016)	Turkey	S1: 618 seventh graders S2: 758 seventh graders S3: 8,318 seventh graders	Cross-sectional survey Validation of measurements	+		✓				
96	Xu et al. (2022)	China	823 ninth graders (mean age 15.1)	Cross-sectional questionnaires with a delayed achievement test in mathematics	+		✓				
Small-scale qualitative studies											
5	Bardine (1999)	USA	12 sophomore students in an Honor English class (age 15–16)	Multiple data sources (questionnaire, interviews, focus gr.)	+				✓		
17	Dang (2021)	Vietnam	31 tenth graders (ages 15–16)	Questionnaire and semi-structured interviews	+				✓		✓
46	Luan and Ishak (2018)	Malaysia	12 high school students (Est. age 13–16)	Mixed-methods research design	+			✓			✓

containing actionable steps for improvement, which aligns with the other findings of this review. However, in another large-scale study, where the first 15 min of the lessons were observed in ~1,500 classrooms, they found that an instructional practice of giving students positive feedback and an opportunity to respond significantly predicted school-wide outcomes (Scott and Gage, 2020). Higher rates of positive teacher feedback were associated with lower school-wide suspension rates and higher percentages of students scoring proficient or distinguished on the state academic assessments in math and reading. This association was stronger among the elementary students than secondary students. Consequently, the researchers suggest that early and frequent positive reinforcement can have long-lasting preventive effects on behavior and academic success.

3.1.3 Teacher feedback and student achievement in small-scale studies

Only three small-scale studies explored the relationship between teacher feedback and achievement (see Table 2). One study examined teachers' written feedback on students writing and found that praise could be good for their motivation, but more comprehensive feedback was needed to improve their performance (Bardine, 1999). Valuable feedback should contain constructive comments that can help students understand their mistakes and areas for improvement and help them see writing as an iterative process. The study found that teachers' feedback directly influences achievement when it is clear, actionable, and aligned with opportunities for revision.

Another study that also focused on writing found that teacher feedback played a critical role in guiding students through the discovery, correction, and rewriting processes (Dang, 2021). The students reported that teacher feedback helped them improve their grammatical accuracy and link ideas logically within their writing. However, some students indicated that over-reliance on teacher feedback could reduce independent critical thinking.

In the last study, direct vs. indirect written corrective feedback was explored in a class of English second language learners (Luan and Ishak, 2018). The researchers concluded that a blended approach with direct (e.g., marking errors and providing the correct response) and indirect (e.g., just marking the error with code without giving the correct response) feedback was the best option for improving students' writing achievement. They found that direct feedback helped students improve their revision accuracy, especially for low-proficiency students. On the other hand, the indirect feedback encouraged the students to actively engage in the feedback by cognitive processing as they worked to identify and correct errors themselves.

3.1.4 Brief summary of the findings concerning feedback and achievement

Altogether, most studies indicate that the content and quality of teacher feedback are the most important predictors of student achievement. Feedback should be tailored, informative, accurate, timely, and action-oriented. Praise and general encouragement can have a positive effect on student motivation but appear to have less direct impact on achievement. Corrective feedback

should be balanced with offering guidance for improvement. For underachieving students, moderate expectations from the teacher about what they can achieve may affect both motivation and achievement.

3.2 Teacher feedback and cognitive outcome

3.2.1 Teacher feedback and cognitive outcome in intervention studies

Twenty-one intervention studies examined how teacher feedback is related to various cognitive outcomes (see Table 3). Moreover, motivation, in some form or another, was the most reported outcome (18 studies). Three studies were theoretically grounded in self-determination theory (Ryan and Deci, 2017) and with concepts such as intrinsic motivation, competence, and relatedness as outcomes (De Meester et al., 2020; Eckes and Wilde, 2019; Krijgsman et al., 2021). One study in physical education found that adding positive feedback to the corrective feedback reduced the students' frustrations related to competence and relatedness (De Meester et al., 2020). This was particularly prominent among students at low achievement levels. Conversely, another study in physical education found that oral feedback related to clarifying goals and the working process did not change students' need satisfaction (competence, autonomy, and relatedness) (Krijgsman et al., 2021). Nevertheless, a study that explored a more comprehensive form of feedback called "tutoring feedback"—which included support for strategic problem-solving, error detection and correction, reflective questioning, and encouragement for independent elaboration—found that it significantly enhanced students' intrinsic motivation, flow experiences, and perceived competence in a biology class setting (Eckes and Wilde, 2019).

Several studies have identified process-oriented feedback as significant for promoting students' self-efficacy for learning and performance. In an experimental study, self-referenced feedback (which highlighted how students could improve their performance) was tested against norm-referenced feedback (which highlighted how their performance compared to others in their group) in the context of language learning (Chan and Lam, 2010). While the self-referenced feedback had a positive effect on both students' self-efficacy and their control beliefs, the norm-referenced feedback led to a reduction in self-efficacy and lower control beliefs. Another study combined various goals with different kinds of teacher feedback in remedial reading (Schunk and Rice, 1991). The students who received process goals and progress feedback demonstrated the highest self-efficacy and control beliefs. In another experiment that targeted strategic reading, the combination of feedback on strategy utility with fading overt verbalization over time (internalization of strategies) significantly improved students' self-efficacy, comprehension skills, and self-reported strategy use (Schunk and Rice, 1993). However, self-efficacy could also serve as a mediator of the relationship between feedback and another learning-related outcome. This was illustrated in a 10-week-long intervention on mathematical reasoning with three levels of feedback (task level, process level, and

TABLE 3 Overview of the included intervention studies on students' cognitive, emotional, and behavioral outcome of teacher feedback.

Record	Reference	Country	Sample	Design	Outcome	Moderator
1	Admiraal et al. (2020) C	The Netherlands	47 seventh graders	Intervention/action research with mixed method approach	Low-performing students found the feedback and individualized attention beneficial	Teachers used information from learning analytics to tailor their feedback to students
3	Al-Darei and Ahmed (2022) C	Oman	97 (age 13–14)	A quasi-experimental design with three groups	Increase in general motivation	Explanatory feedback (correct, incorrect, and justification) compared to feedback with less information in an E-learning context
11	Chan and Lam (2010) C	Hong Kong	Stud1: 79 eighth graders, Stud 2: 77 seventh graders	Randomized controlled trial design	Increased self-efficacy and control beliefs	Self-referenced feedback: highlighting how students could improve their performance
12	Chang et al. (2020) C	Taiwan	51 fifth graders	Quasi-experimental Design	Students in the peer-collaborative feedback condition increased their self-efficacy and critical thinking	Students participated in a VR project under two conditions: classical teacher-directed or peer-collaborative feedback
18	De Meester et al. (2020) C, E	Belgium	277 (age 12)	An experimental 2 × 2 design	Reduced the students' frustrations related to competence and relatedness	Adding positive feedback to the corrective feedback in physical education
19	Eckes and Wilde (2019) C	Germany	165 (age 12)	Quasi-experimental pre-post-test design	Enhanced intrinsic motivation, flow experiences, and perceived competence	A comprehensive form of feedback called "tutoring feedback" in biology
20	Erturan-Ilker (2014) C	Turkey	47 (ninth graders)	Experimental study	Increased mastery-approach and performance-approach goals, reduce performance-avoidance goals	Positive feedback that emphasizes encouragement, praise, and recognition of good performance in physical education
37	Koenka (2022) C	Canada	161 female students (grades 7–9) in math and science	A cluster-randomized experimental study	Increase in interest and preferences for mastery goals	Feedback with a combination of grades and comments in science and math
40	Krijgsman et al. (2021) C	The Netherlands	492 seventh graders	Quasi-experimental 2 × 2 factorial design	No significant change	Oral feedback related to clarifying goals and the working process in physical education
58	Ozan and Kincal (2018) C, E, B	Turkey	45 fifth graders	A quasi-experimental design with pre-post-test and control group	Positive attitudes toward social science, students found the learning approach engaging and enjoyable. Increased self-regulated learning	Focus on goals and criteria, increased student inquiry and dialogue, and specific tailored progress feedback
60	Pinger et al. (2018) C	Germany	426 ninth-grade students (age 15) 17 Teachers	Quasi-experimental design	Increased interest in the study subject	Individually tailored feedback and highlighting the usefulness of the feedback in mathematics
61	Rakoczy et al. (2019) C	Germany	620 students (age 15), 26 teachers	Intervention study with control group	Increased interest, self-efficacy, and perceived usefulness of the feedback	Comprehensive process and product feedback in mathematics
67	Sandal et al. (2022) C, B	Norway	1,003 ninth graders and 40 teachers	Intervention/action research with mixed method approach	Positive changes in students' engagement but limited change in students' perceptions of feedback	Mainly a teacher intervention: Changing mindset and practice of feedback using various feedback forms
68	Santanaton and Chinokul (2022) C, E, B	Thailand	26 tenth graders from an all-girls school	The study used a mixed-method experimental design	Temporary increase in students' engagement (cognitive, emotional, and behavioral) and attentiveness to error, but no change in students' attitude to feedback and learning	Strengthened grammar feedback with the use of error codes and explanations in English foreign language
69	Schunk and Rice (1991) C	USA	30 fifth graders	Randomized controlled trial design	Increased self-efficacy and control beliefs	Process goals combined with progress feedback in a remedial reading class
70	Schunk and Rice (1991) C, B	USA	44 students (age 10–11)	Randomized controlled trial design	Increased self-efficacy, comprehension skills, and self-reported strategy use	Feedback on reading strategy utility with fading overt verbalization (internalization of strategies) over time

(Continued)

TABLE 3 (Continued)

Record	Reference	Country	Sample	Design	Outcome	Moderator
73	Siero and van Oudenhoven (1995) C	The Netherlands	296 fifth graders (age 10–11)	Randomized controlled trial design	Increased control beliefs and attribution of success to effort, but the effect was diminishing over time	Increased clarification of goals and the feedback emphasized the contingent effort to reach the goal
74	Smit et al. (2022) C	Switzerland	1,261 (grades 4–6)	Quasi-experimental longitudinal design	Improved mathematical reasoning after reaching a certain level of self-efficacy	Intervention on mathematical reasoning with three levels of feedback: (1) task level, (2) process level, and (3) self-regulation level
76	Soncini et al. (2021) C, E	Italy	108 fifth-graders	Pre-post experimental design	Positive error-handling strategies enhanced students' perceptions of a supportive and trustful error climate and reduced anxiety levels	Positive vs neutral handling strategies. PHS = Teachers encouraged learning from errors, provided constructive feedback, and emphasized the growth potential
92	Wiggins et al. (2017) C, B	England	Approx. 6,500 pupils from 97 schools (ages 9–11)	Randomized controlled trial design	Students enjoyed the system and tended to increase their engagement, but it had no other academic outcomes	A handheld device allowed teachers and pupils to provide immediate feedback during lessons
94	Wollenschläger et al. (2016) C, B	Germany	120 eighth graders	Randomized controlled trial design	Extensive task information enhanced perceived competence, calibration accuracy, and experiment planning performance	Teacher feedback intervention with three types of rubrics

Letters in bold indicate the coding of the study, respectively cognitive (C), emotional (E), and behavioral (B) outcome.

self-regulation level). The study revealed that the learning outcome first appeared after the students had reached a certain level of self-efficacy ([Smit et al., 2022](#)).

Several studies indicate that feedback may also positively affect students' interests and attitudes when the feedback is sufficiently comprehensive, specific enough, and perceived as valuable ([Al-Darei and Ahmed, 2022](#); [Pinger et al., 2018](#); [Rakoczy et al., 2019](#); [Nunez et al., 2015](#)). For example, in a quasi-experimental study of ninth graders in mathematics that focused on providing individually tailored feedback and highlighting the usefulness of the feedback, students showed increased topic interest ([Pinger et al., 2018](#)). In a more comprehensive intervention study, where feedback was individualized, weaknesses and areas for improvement were identified, strategic recommendations were provided, and learning goals were emphasized, researchers found positive effects on students' interest, self-efficacy, and perceived usefulness ([Rakoczy et al., 2019](#)). A similar comprehensive intervention study, which emphasized explaining learning objectives and success criteria, fostering inquiry and dialogue among students, providing targeted comments on assignments, and offering individualized feedback on progress, found that students developed more favorable attitudes toward social science studies, perceiving studies as more engaging and enjoyable ([Nunez et al., 2015](#)). These studies indicate that if feedback is clear and understandable for the students and perceived as valuable for one's progress, the feedback alone (or in combination with other instructional measures) may contribute to increased engagement and interest in the subject being studied.

Although we have briefly touched on how students' goal orientation can relate to teacher feedback, several studies have looked more specifically at this. In an experimental study in math and science with lower-secondary girls, four conditions of feedback (grades, comments, grades and comments, no feedback)

were tested upon various motivational outcomes ([Koenka, 2022](#)). The results revealed that intrinsic motivation increased among students who received comments only. For those students who received grades and comments, their intrinsic motivation and their preferences for mastery goals increased. However, the latter group also tended to experience a decrease in self-efficacy, which was explained by the fact that many students perceived receiving grades and critical comments as overwhelming. The students who received grades only had less favorable motivational outcomes than those receiving comments, while those who did not receive any feedback highlighted performance approach goals. In another six-week intervention ([Erturan-Ilker, 2014](#)) conducted in the context of physical education, the researchers tested the relationship between positive and negative feedback and different goal orientations. Positive feedback emphasized encouragement, praise, and recognition of good performance, effort, and ability, while negative feedback highlighted deficiencies or underperformance, focusing on individual effort, ability, and outcome. Not so surprisingly, positive feedback led to increased preferences for mastery goals (focus on improving yourself) and performance approach goals (outperform others), a reduction in performance-avoidance goals (focus on avoiding failure), and a more mastery-oriented climate in the class. Negative feedback increased the student's performance-avoidance goals and reduced their preferences for mastery goals.

Results from several studies indicate that changing students' and teachers' beliefs, attitudes, or practices more permanently is challenging. For instance, four different conditions were tested in a study of contingent feedback (making the connection between the feedback and task performance more visible to the student) ([Siero and van Oudenhoven, 1995](#)). In the most successful condition, which contained increased visibility, explicit references to the effort as a cause for performance outcomes, and introduction of clear

goals, students boosted their control beliefs and improved their achievement. However, the positive effect seemed to diminish over time. In another intervention focusing on improving grammar in English writing, the researchers found an immediate increase in student engagement and use of strategies (Santanatonon and Chinokul, 2022). Still, the effect eventually waned because students forgot the strategies they had learned, and the new practice was not maintained. Finally, in a more extensive intervention study with 40 teachers and more than 1,000 students, the researchers aimed to change teachers' and students' perceptions and beliefs of feedback from the more traditional summative thinking to formative thinking (Sandal et al., 2022). The project included teacher seminars, school-based workshops on goal setting, and various formative feedback forms/activities (e.g., formative use of tests, planned dialogues, and use of learning partners). During the 7-month intervention period, one revealed improved practices and changes in the teachers' awareness of formative feedback's function to enhance learning, self-regulation, and student engagement. Even though an increased engagement was seen among the students, their attitude toward feedback did not change. They still primarily viewed feedback as summative, focusing on grades rather than as a tool for learning.

Several studies have included technology or tools to assist with the feedback, and the outcomes are mixed. In one study (Admiraal et al., 2020), teachers used information based on learning analytics to tailor students' learning tasks and their feedback. The results revealed that the adapted tasks and feedback benefited low-performing students, as they experienced improved understanding, increased engagement, and effort, and they valued the feedback more. On the other hand, high-performing students did not see adapted tasks and feedback as much value added. However, the results indicated that these students improved their self-confidence and pride by helping their peers. Another common tool in formative assessment and feedback is rubrics (Wollenschläger et al., 2016). A study tested three variations of rubrics in science education, ranging from the most limited—providing only the learning goal (Condition 1)—to the most extended (Condition 3), which included specific feedback on the student's current performance, explicit instructions for improvement, and a rubric indicating achieved levels while leaving uncompleted levels unmarked. The results revealed that the students in the third condition improved their planning ability over time, increased their perceived competence, and improved their ability to evaluate their performance. Moreover, the researchers concluded that task improvement information was the most critical component for successful teacher-given rubric feedback.

Finally, we want to mention two studies (also mentioned in the achievement section) where technology is a key feature or encapsulates the feedback. In the first study, an electronic handheld device that allowed teachers and students to provide immediate feedback during lessons was tested across several subjects in a large number of schools (Wiggins et al., 2017). Even though both students and teachers had largely positive experiences with the system, and one saw short-term positive effects on student motivation, particularly in terms of engagement and enjoyment, these were insufficient to overcome the broader challenges or lead to sustained improvements in academic performance. Lastly,

we want to mention the study made in the context of a virtual reality design in natural science, where researchers tested a peer assessment instructional design upon a more classical instructional design with teacher feedback (Chang et al., 2020). Their findings indicated that the teacher feedback approach provided clear and directed support, but the peer assessment approach yielded better outcomes in fostering critical thinking, self-reflection, and deeper engagement. These latter findings may indicate that the success of feedback also might depend on the learning content and how the instruction is orchestrated.

3.2.2 Teacher feedback and cognitive outcome in observational studies

Overall, 47 of the included observational studies dealt with cognitive phenomena (see Table 4), and due to the large number of studies in this category, we cannot, for reasons of space, elaborate on all of the studies but rather present the main features of these studies. Though most observational studies are based on students' perceptions through the data (e.g., self-reported data, questionnaires, interviews), 17 studies focused specifically on students' perceptions or experiences of feedback. This is, for instance, about how students with different personal characteristics and backgrounds experience various types of feedback. In addition, some studies compare students' and teachers' feedback experiences.

Four studies indicate that males and females may perceive the feedback differently or actually receive different feedback. A Chinese study found that female students felt they received more directive feedback and less criticism than males (Guo, 2021). Another study from France (Nicaise et al., 2007) revealed that girls reported more encouragement after errors, while boys noted more criticism and felt ignored. Moreover, two studies from Denmark reported that girls sensed that they received less feedback than boys (Sortkaer, 2019; Sortkaer and Reimer, 2021), which the authors explained by unconscious teacher bias. The studies from Denmark also indicated that students with higher SES and high-achieving students received less feedback than those with lower SES and low-achieving students.

Two studies compared teachers' and students' perceptions of feedback (Pat-El et al., 2015; Van der Kleij, 2019) and found that teachers often believe they provide clear and constructive feedback, but students may not perceive it similarly. Instead, the students often find the feedback insufficiently tailored and actionable or too focused on grades. An interesting finding in one of these studies (Pat-El et al., 2015) was that students with higher language proficiency experience feedback more similarly to teachers, which may indicate a challenge in communication and individual adaptation.

Several studies explored students' perceptions of a specific feedback form and linked them to particular outcomes. One study focused on students' conception of feedback (Lee, 2021) and found that students linked process feedback to formative and summative assessment. In contrast, corrective feedback was associated with summative assessment, while outcome feedback was related to surface-level learning. Another study (Krijgsman et al., 2019) linked process feedback to the satisfaction of students' basic psychological needs (the concepts of self-determination theory, Ryan and Deci,

TABLE 4 Overview of the included observational studies on students' cognitive, emotional, and behavioral outcome of teacher feedback.

Record	Reference—coding	Country	Sample	Design	Outcome—Main findings	Moderators
7	Beghetto (2006) C	USA	1,322 middle school students (mean age 14)	Cross-sectional design: Questionnaire	Positive feedback from teachers about creativity predicted students' creative self-efficacy and their belief that they could generate creative ideas	Positive feedback about creativity
8	Brooks et al. (2019) C	Australia	691 five graders (age 9–10)	Cross-sectional design: Questionnaire	Students rate explicit feedback focused on improvement and the next steps over prompts for self-reflection and self-regulation. Students are less familiar with practices for self-regulated learning	Students' feedback preferences
9	Burner (2016) C, B	Norway	100 eighth and nine graders and their teachers (English Classes)	Mixed-methods design: Questionnaire, interviews, focus groups, observations	Students preferred frequent writing practice and valued feedback that focused on improvement. Due to a lack of understanding, students often do not follow up on teacher feedback	Students feedback preferences. There is a gap between teachers' intentions in formative assessment and students' actual experiences
10	Carrillo-López et al. (2022) C	Spain	172 students (age 10–13) (Physical Education)	Cross-sectional design: Questionnaire and attention test	Students with lower attention levels perceived more metacognitive feedback from their teachers, which helped them better understand the tasks and their learning progress	Students' level of attention in physical education
13	Chi et al. (2021) C, E	China	9,841 students (age 15)	Large scales cross-sectional design: Questionnaire (PISA 2015)	Frequent teacher feedback was positively related to a more sophisticated understanding of science and higher interest and enjoyment in science	Teacher feedback moderated the relationship between inquiry-based science practices and students' epistemological beliefs about science
14	Cowie (2005a) C, B	New Zealand	106 seven- to ten-graders (Science Education)	Case design. Interviews with teachers and students and classroom observations	Students preferred tailored feedback with suggestions rather than direct instructions or evaluative comments. Negative evaluative feedback is damaging to motivation. Students were likelier to act on feedback from teachers they trusted and respected	Students' feedback preferences: Tailored and one-to-one feedback, simple language, and mutual trust and respect in the teacher-student relationship
16	Cunha et al. (2019) C, B	Portugal	4,288 sixth graders, 170 mathematics teachers	Mixed methods sequential explanatory design. Questionnaires and interviews	Praise was associated with emotional engagement, while constructive criticism was related to cognitive engagement. Checking homework was associated with cognitive and behavioral engagement	Teachers' feedback on homework: Positive feedback, checking homework, grading, and individualized feedback
22	Gamlem and Munthe (2014) C, B	Norway	19 classrooms (age 13–16), 28 teachers	Video-based classroom observation study of 56 lessons	Feedback was predominantly encouraging, with limited emphasis on learning or understanding. Teachers' communication of learning goals was weak, and students' opportunities to engage in deep thinking, reflection, and self-regulation were limited. A positive correlation was found between a positive classroom climate and feedback quality	The quality of teacher-student interactions
24	Ganapathy et al. (2020a) C	Malaysia	482 students (age 16) and 15 teachers.	Mixed methods convergence parallel design using questionnaire and focus group interviews	Students prefer comprehensive feedback, marking all grammar, content, and vocabulary errors. Teachers and students are misaligned about the perceived practice	Students' feedback preferences. Teachers' written corrective feedback to English second language learners
25	Ganapathy et al. (2020b) C	Malaysia	720 students (age 16)	Cross-sectional design using a questionnaire	Most students preferred and benefited from direct feedback. Clear and detailed corrections made errors more straightforward to understand	Students' feedback preferences. Teachers' written corrective feedback to English second language learners
26	Guo (2021) C, B	China	444 tenth graders (ages 15–16) using a questionnaire	Cross-sectional design using a questionnaire	Female students felt they received more directive feedback and less criticism than males. Males reported greater use of critical thinking strategies, while females emphasized self-resource management	Gender differences: Scaffolding feedback (hints or clues to help students arrive at the correct answers independently)
28	Harris et al. (2014) C, E	New Zealand	193 students from grades 5 to 10 (ages 9–15).	Mixed-methods design. Questionnaire on student conceptions	Students preferred teacher-led feedback. Feedback was seen as task-oriented, focusing on performance, standards, and improvements. Constructive feedback was	Student conceptions of feedback

(Continued)

TABLE 4 (Continued)

Record	Reference–coding	Country	Sample	Design	Outcome—Main findings	Moderators
				of feedback, checklist, and free-response drawing	associated with positive emotions	
29	He et al. (2023) C, B	China	236 seventh graders	Intervention design, but the intervention effect is not examined—correlation analyzes of questionnaire data	Positive feedback perceptions promote cognitive and self-regulation strategies, with self-efficacy and mastery goals mediating its link to self-regulated learning	Perceptions of feedback in web-based science learning
30	Helm et al. (2022) C	Germany	34,771 students (age 15)	Large scale Cross-sectional study (PISA 2000)	Students' perception of individualized teacher-framed feedback positively correlates with their academic self-concept. The relationship is more substantial for high-achieving students	Students' perception of individualized teacher-framed feedback (emphasizes individual progress and effort), achievement level
31	Henry et al. (2020) C	USA	An unspecified number of sixth to eighth graders and a special education class	Cross-sectional mixed methods design with questionnaire and group interviews	Both feedback modes were well-received: students valued asking questions in face-to-face sessions and appreciated digital feedback's privacy and replayability. However, due to time constraints, face-to-face conferencing did not reach all students, while screen-casting conferencing suffered from a lack of student-teacher interaction and missing clarification	Students' perceptions of face-to-face and screen casting (digital) conferencing in a writing workshop
34	Jang et al. (2015) C, E	Canada	44 fifth- and sixth-graders and their teachers and parents	Mixed method design with questionnaires, interviews and reading achievement test	Mastery-oriented students engaged critically with feedback, while performance-oriented students saw it as a competence measure, expressed a fixed view of intelligence, and were less likely to engage with improvement. The feedback triggered several emotional outcomes (frustration, surprise) related to over- and underestimation of competence	Holistic diagnostic feedback: Students' perceived abilities, goal orientations, perceptions of their parents' goal orientations, and sociocultural and linguistic backgrounds
35	Jiang et al. (2021) C	6 Western and 6 East Asian countries	89,869 students (age 15)	Large scale Cross-sectional study (PISA 2015)	Teacher feedback significantly positively impacted student motivational beliefs in both Western and East Asian contexts. However, the correlation between feedback and instrumental motivation was somewhat higher for East Asian students	Cultural differences in feedback associations with beliefs
38	Koka and Hein (2003) C, E	Estonia	783 students (age 12–15)	Cross-sectional correlational study with questionnaire variables	Positive general feedback boosted perceived competence and enjoyment, whereas specific feedback had less motivational impact. Positive feedback reinforced students' sense of self-worth	Positive general feedback (praise, encouragement) and positive specific feedback (detailed, targeted instruction) in physical education
39	Koka and Hein (2006) C	Estonia	302 students (age 11–15)	Longitudinal design was done with a questionnaire two times over two years	Positive general feedback at time 1 positively affected students' intrinsic motivation at time 2. Informational feedback had no direct effect on motivation	Perceived positive general feedback and perceived informational feedback (specific instructions on how to improve performance) in physical education
41	Krijgsman et al. (2019) C	The Netherlands	570 seventh to tenth graders (mean age 13.76—few students are older than 16)	Longitudinal design with six repeated measurements using questionnaires	Perceived process feedback and goal clarification were positively associated with the satisfaction of students' basic psychological needs and negatively associated with need frustration	Perceived process feedback and goal clarification physical education
42	Lee (2008) C	Hong Kong	58 seventh graders (ages 12–13) and their teachers	A mixed-method design over 9 months with questionnaires, checklists, and observation, interviews	Students preferred comments with solutions and explanations alongside error feedback and grades, while error-focused feedback demotivated low-performing students	High- and low-performing students in English as foreign language writing

(Continued)

TABLE 4 (Continued)

Record	Reference–coding	Country	Sample	Design	Outcome—Main findings	Moderators
43	Lee (2021) C	Taiwan	313 eighth graders (age 14)	Cross-sectional design, questionnaire	Outcome feedback was associated with surface-level learning, corrective feedback with summative assessment, and process feedback with both formative and summative assessment	Students' perception and conception of outcome, corrective and process feedback
47	Lui and Andrade (2022) C, E, B	USA	93 seventh graders (ages 12–13)	Mixed-methods design with questionnaires and think-aloud protocols	Most students had positive emotions (interest, calm, hope) about their teacher's feedback and attributed it to controllable factors (effort, strategies). Task value influenced their responses to feedback	Perceptions of feedback, emotions, attribution, value consideration
48	Mælan et al. (2021) C	Norway	1,755 eighth to tenth graders	Cross-sectional design with questionnaire	Students received less feedback during homeschooling, mainly written. Low-achieving students rated the feedback higher but suffered most from the lack of oral feedback and direct interaction	Homeschooling during the COVID-19 pandemic, written feedback vs. oral feedback and direct interaction. Students' achievement level
49	Mak (2019) C, B	Hong Kong	63 students (ages 11 and 12) and two teachers	One-year longitudinal mixed methods design with questionnaires, interviews and observations	Students shifted to valuing focused coded feedback, appreciating clear criteria before, constructive input during, and reflection after writing. This change increased students' motivation, engagement, and confidence	A three-stage feedback model replaced traditional feedback (pre-feedback, during-feedback, post-feedback) in writing. Goal-setting sheets and error logs were used
50	Martin et al. (2022) C, B	Australia	61,879 seventh to tenth graders	Longitudinal survey design with two data collection time points	Feedback-feedforward enhanced growth goal setting and academic engagement directly and indirectly. Growth goal setting mediates the relationship between feedback-feedforward and engagement outcomes	Feedforward-feedback and growth goal setting
53	Monteiro et al. (2021) C, B	Portugal	1,188 sixth to tenth graders	Cross-sectional design with questionnaire and multi-level analyzes	Effective feedback targeting task, process, and self-regulation enhances autonomy, self-efficacy, and learning strategies and fosters a supportive classroom. Efficient feedback relates to engagement and identification	Classroom-level dynamics, various feedback practices
55	Nicaise et al. (2007) C, E, B	France	325 tenth graders (mean age of 16 years)	Cross-sectional design with a questionnaire and teacher report on student performance	Praise and attention boosted perceived competence, effort, and enjoyment, while criticism reduced enjoyment and performance. Girls reported more encouragement after errors, while boys noted more criticism and felt ignored	Positive Feedback (praise and invested time) vs. negative feedback (criticism and encouragement) and gender in physical education
56	Nunez et al. (2015) C, B	Spain	454 students in grades 5–12 schools (ages from 10 to 16)	The cross-sectional survey	Increased homework was completed, and time management during homework improved. Students perceived a lower amount of feedback with increasing grade levels	Regular homework review by the teacher with tailored and constructive feedback
57	Oinas et al. (2021) C, E, B	Finland	132 fifth and sixth graders	Cross-sectional mixed methods design with questionnaires and group interviews	Technology-enhanced feedback often promotes external behavior regulation over fostering self-regulated learning. Positive notes sparked positive emotions, while critical or unclear feedback caused negative ones. FB practices varied across classrooms	Technology-enhanced feedback that includes the use of emojis
59	Pat-El et al. (2015) C	The Netherlands	650 students (mean age 13.8). 38 teachers	Cross-sectional design with questionnaires to students and teachers	Teachers often believe they provide clear and constructive feedback, but students may not perceive it similarly. Students with higher language proficiency exhibit closer alignment with teachers' perceptions of feedback	Students' and teachers' perceptions of feedback practices. Students' language proficiency
71	Scott and Gage (2020) B	USA	Est. 27,000 students. (ages 10–16; 1,500 classrooms)	Large-scale study with multiple datatypes	Schools with higher rates of positive feedback provided by teachers had lower suspension rates	Emphasizing a high ratio of positive to negative feedback in general
72	Sewagegn and Dessie (2020) C, B	Ethiopia	474 fifth to eighth graders	Cross-sectional study, questionnaire and document reviews	Students found timely, detailed feedback most useful for identifying learning gaps, revising assignments, and planning future strategies. The most effective feedback clarified grades, offered detailed suggestions, and showed how to improve	Students' preferences. The specificity and content of the feedback (quality)

(Continued)

TABLE 4 (Continued)

Record	Reference–coding	Country	Sample	Design	Outcome—Main findings	Moderators
75	Sokmen (2021) C, E, B	Turkey	407 students (mean age 13.25) (sciences classrooms)	Cross-sectional design with questionnaires	Teacher feedback positively influenced all aspects of student engagement, including behavioral, emotional, cognitive, and agentic engagement. Effective feedback helped students gain confidence in their ability to perform science tasks	Clear, comprehensible, and constructive feedback focused on learning and understanding rather than correction
77	Sortkær (2019) C	Denmark	1,101 students (ages 14–15)	Cross-sectional study using a questionnaire	Students with higher cultural capital received more teacher feedback than their peers with lower cultural capital, possibly due to unconscious teacher bias. Girls perceived less feedback than boys, reflecting potential classroom dynamics or communication differences	Cultural capital, amount and quality of feedback, gender and classroom dynamic
78	Sortkær and Reimer (2021) C	Denmark	1,098 eighth and ninth graders (ages 14–15)	Cross-sectional design using a questionnaire	Boys reported receiving more teacher feedback than girls, while girls perceived more peer feedback. In higher-SES classrooms, students noted less teacher feedback but increased peer feedback. Higher-performing students perceived receiving less feedback	Student perceptions related to gender differences. Socioeconomic status and performance level
81	Tan et al. (2019) C, B	Australia	32 ninth graders (ages 14–15)	Cross-sectional study with semi-structured interviews	Two-way feedback fosters dialogues, clarifies understanding, and enhances student agency, empowering them to develop self-regulation skills	Students' preferences regarding two-way feedback vs. one-way feedback
82	Tas et al. (2016) C, B	Turkey	S1: 618 seventh graders, S2: 758 seventh graders, S3: 8,318 seventh graders	Cross-sectional survey Validation of measurements	Teacher feedback on homework was positively associated with students' homework self-regulation. The feedback helped students adopt mastery and performance goals, deep learning, and management strategies during homework	Effective homework feedback included regular checks, timely evaluations, and performance insights on strengths and weaknesses
84	Tay and Lam (2022) C, B	Singapore	45 students (ages 14–15)	Longitudinal qualitative design. Data based on students' written assignments and focus group interviews	Personal feedback, like “Good effort,” was unhelpful without specific improvement suggestions. Highlighting strengths boosted motivation, while actionable feedback drove improvement. Class discussions, consultations, and pre-feedback tools like success criteria checklists aided feedback processing	A mix of corrective feedback and personal-level feedback, pre-task feedback (rubrics, success criteria checklists, and reflection), post-task feedback (class discussions, worksheets, individual consultations)
88	Van der Kleij (2019) C	Australia	186 students from grades 7–10 (ages 12–16) and 59 teachers	Cross-sectional mixed method with a questionnaire, open-ended questions, and grade information	Teachers viewed feedback quality and facilitation more positively than students. Self-efficacy, intrinsic motivation, and self-regulation strongly influenced student perceptions of feedback quality. Many students found feedback insufficiently tailored and actionable or too focused on grades	Students' and teachers' perceptions of feedback, students' characteristics
89	Vatøy and Smith (2019) C	Norway	1,137 students in English foreign language classrooms (age 13–16)	Cross-sectional design: Questionnaire	Perceived learning goal support, subject interest and perceived self-regulation skills in English predicted students' perceived usefulness of teacher feedback	Subject interest, learning goal clarification and self-regulation skills
90	Vergara-Torres et al. (2021) C, E, B	Mexico	890 sixth graders (age 11–13)	A cross-sectional design, questionnaire	High-quality task presentations were positively linked to the amount of corrective feedback students found legitimate. Autonomy, competence, and relatedness mediated the impact of feedback on students' energy, enthusiasm, and wellbeing	Quality task presentations. Students' perception of feedback legitimacy and basic psychological needs in physical education
91	Vergara-Torres et al. (2020) C	Mexico	742 students (ages 10–13)	Cross-sectional design, questionnaire	Corrective feedback was positively linked to perceived legitimacy (fairness and reasonableness). Perceived legitimacy mediated the relationship between corrective feedback and students' psychological needs (competence and relatedness)	Students' perception of feedback legitimacy and basic psychological needs in physical education

(Continued)

TABLE 4 (Continued)

Record	Reference–coding	Country	Sample	Design	Outcome—Main findings	Moderators
93	Williams (2010) C	New Zealand	56 eighth graders (ages 12–13)	Cross-sectional mixed-methods study combining a questionnaire with semi-structured interviews	Students saw feedback as vital for improving work and understanding goals, identifying strengths, areas for improvement, and next steps. Though preferences varied, they preferred individualized, actionable, and corrective feedback. Girls found feedback more helpful and were more aware of its type and frequency than boys	Students' perceptions and judgement of useful feedback, Gender differences
95	Xu (2022) C, B	China	3,018 eighth graders	Cross-sectional design with student questionnaire	Feedback quality played a more significant role in promoting homework purposes compared to feedback quantity. The quantity of feedback impacted self-regulatory and approval-seeking, while quality impacted students' motivation and purposes	Feedback quality and quantity on homework
96	Xu et al. (2022) C, B	China	823 ninth graders (mean age 15.1)	Cross-sectional questionnaires with a delayed achievement test in mathematics	Latent profile analyzes with covariates reveal that students who reported higher perceived teacher homework involvement demonstrated significantly higher homework effort and completion than those in lower-involvement profiles	Students' perceptions of teacher homework involvement and their homework behavior
99	Zohra and Fatiha (2022) C	Algeria	40 students (ages 11–15) and 40 teachers.	A cross-sectional descriptive research design with a quantitative approach	60% of learners preferred direct corrective feedback (explicit corrections). 70% of learners preferred unfocused feedback (all errors are corrected). 15% of learners preferred indirect feedback (non-corrections). Teachers mostly preferred indirect feedback (prompting self-correction) or focused feedback	Students' and teachers' preferences for corrective feedback English as a Foreign Language
100	Zumbrunn et al. (2016) C, E, B	USA	598 sixth to tenth graders	Cross-sectional mixed-methods design, questionnaire with closed and open-ended questions	Writing feedback perceptions mediated the link between self-efficacy and self-regulation. Students valued feedback for skill improvement (80%) or emotional benefits (17%) but disliked it due to disregard (65% - dislike of negative or critical feedback) or negative emotions (23%)	Students' perception and experiences of feedback in writing

Letters in bold indicate the coding of the study, respectively cognitive (C), emotional (E), and behavioral (B) outcome.

2017). However, other studies indicate that corrective feedback can also positively impact students' basic psychological needs if the feedback holds sufficiently high quality ([Vergara-Torres et al., 2021, 2020](#)). In these latter studies, students' judgement of the feedback's legitimacy was conceptualized as a mediator between the feedback given and the psychological outcome. Two studies linked positive perceptions of teacher feedback to the use of cognitive strategies ([He et al., 2023](#)) and intrinsic motivation ([Koka and Hein, 2006](#)), while another study linked the perceptions of individualized feedback to academic self-concepts ([Helm et al., 2022](#)). Finally, one study linked perceived learning goal support, subject interest and perceived self-regulation skills in English to students' perceived usefulness of teacher feedback ([Vattøy and Smith, 2019](#)). Although these findings are interesting in their own right, we will remark that many of them reveal from explorative studies, appear isolated or are made in specific contexts, making it difficult to draw generalizable conclusions.

Thirteen studies concern students' own preferences for feedback, and a consistent finding is that students prefer direct, individualized, comprehensive, and detailed feedback with suggestions for improvement ([Brooks et al., 2019](#); [Burner, 2016](#); [Cowie, 2005a](#); [Ganapathy et al., 2020b,a](#); [Lee, 2008](#); [Sewagegn and Dessie, 2020](#); [Tay and Lam, 2022](#); [Williams, 2010](#); [Zohra and Fatiha, 2022](#); [Zumbrunn et al., 2016](#)). According to some

studies, students rate explicit feedback focused on improvement over prompts for self-reflection and self-regulation ([Brooks et al., 2019](#)), which might be the type of feedback teachers often prefer. However, studies also indicate that more indirect feedback, e.g., prompting self-reflection or further processing, can also be valued by students if it's given systematically and the students are made familiar with the type of processing it requires ([Mak, 2019](#)). Some studies indicate that students sometimes struggle to understand teachers' feedback ([Burner, 2016](#); [Cowie, 2005a](#)), and consequently, the possibility of dialogue between teachers and students is about the things the students value ([Tan et al., 2019](#)). Such a dialogue provides opportunities to elaborate on the feedback and clarify the message. Furthermore, in some studies, mutual respect and trust between teacher and student are highlighted as essential to translating feedback into action ([Cowie, 2005a](#)). When it comes to feedback students dislike, they highlight error-focused feedback or criticism they don't understand or consider unfair ([Cowie, 2005a](#); [Lee, 2008](#)). Such feedback is considered demotivating, particularly for low-performing students ([Lee, 2008](#)). Conversely, highlighting strengths is seen as motivating ([Tay and Lam, 2022](#)). However, it should be mentioned that some studies conducted in the context of language learning reveal that students appreciate correcting feedback and marking errors ([Ganapathy et al., 2020b,a](#); [Lee, 2008](#); [Zohra and Fatiha, 2022](#)).

Several studies relate feedback to motivation. For example, studies indicate that constructive critique (Cunha et al., 2019), a high preference for mastery goals (Jang et al., 2015), and clear and comprehensible feedback (Sokmen, 2021) are positively associated with cognitive engagement with feedback. On the other hand, performance-oriented students tend to see feedback as a competence measure, expressing a fixed view of intelligence and being less likely to engage in improvement (Jang et al., 2015). One study suggests effective feedback should target both the task level, the process level, and self-regulation. Furthermore, the results indicate that such feedback can enhance students' autonomy, self-efficacy, the use of learning strategies and foster a supportive classroom environment (Monteiro et al., 2021). Another study suggests that feed-forward (e.g., Hattie and Timperley, 2007) enhances growth goal setting and academic engagement. Studies also indicate that positive feedback in the form of praise can enhance students' perceived competence and effort, particularly in physical education (Koka and Hein, 2003; Nicaise et al., 2007). Finally, we would like to highlight a large-scale study (Jiang et al., 2021, data from PISA 2015) that examined the relationship between perceived feedback and various motivational beliefs among students in East-Asian and Western countries. For students from both hemispheres, the most substantial relation was found with intrinsic motivation. In Western countries, this was followed by self-efficacy, instrumental motivation, and achievement motivation, while in East-Asian countries, the order was instrumental motivation, self-efficacy, and achievement motivation. These findings suggest that some relations between teacher feedback and student motivation are valid across diverse cultures.

The last topic we will address in this section is feedback related to homework, which is the focus of five studies (Cunha et al., 2019; Nunez et al., 2015; Tas et al., 2016; Xu, 2022; Xu et al., 2022). Three studies indicate that regular or frequent teacher reviews of students' homework can increase cognitive engagement and completion rates (Cunha et al., 2019; Nunez et al., 2015; Tas et al., 2016; Xu et al., 2022). Furthermore, if feedback is tailored and of high quality, it can contribute to a higher degree of self-regulation and influence the student's beliefs about the homework purpose (Nunez et al., 2015; Tas et al., 2016; Xu, 2022). Consequently, teachers' engagement in feedback seems to be a key factor that can positively affect students' homework outcomes.

3.2.3 Teacher feedback and cognitive outcome in small-scale studies

In total, 20 small-scale studies explored the relationship between teacher feedback and cognitive outcomes (see Table 5). One study found that students prefer specific, timely, clear, and actionable feedback with opportunities to revise and improve. General praise might be frustrating, while a lack of feedback is demotivating or confusing (Torkildsen and Erickson, 2016). Three studies (Ruthmann, 2008; Tan et al., 2019; Tay and Kee, 2019) pointed to findings where students' knowledge and understanding could increase based on teacher feedback. The first study was a cross-sectional case study highlighting several key

factors in music education (Ruthmann, 2008). It emphasized the importance of teachers' feedback style and respect for student agency. Additionally, the study noted the significance of negotiating creative intent, the classroom environment, and the pedagogical design of composing experiences. These factors supported the development of musical knowledge, creative expression, reflective and metacognitive skills, and problem-solving skills in music technology. The second study, an instrumental case study, showed that students with high-functioning autism spectrum disorder benefitted from teachers' precision in questioning, step-by-step guidance, extended wait time, use of visual supports, and capitalizing on interests (Tay and Kee, 2019). In addition, students benefitted from affirmative and personalized teacher feedback as it enhanced their focus and engagement, increasing the student's knowledge and understanding. The third study (Tan et al., 2019), built on self-determination theory, emphasized that in addition to teachers' asking thought-provoking and open-ended questions, the use of attentive listening was valued and increased students' metacognitive knowledge and understanding (knowledge and regulation of cognition).

One small-scale quasi-experimental study examined the effects of direct and indirect written corrective feedback on students' written performance in English and found that students' attitudes toward feedback, beliefs about what the corrections entailed, and types of scaffolding increased students' knowledge and motivation in writing (Luan and Ishak, 2018). Another quasi-experimental study that focused on reading performance among behaviorally disordered students found that when teachers provided positive written comments on reading assignments each day, in addition to emphasizing contingent upon improved performance and maintained high outcomes, the students improved the accuracy of reading performance, and developed a favorable attitude toward the written feedback process (McLaughlin, 1992).

Three studies (Aedo and Millafilo, 2022; Honora, 2003; Mikume and Oyoo, 2010) found that teacher feedback could enrich students' cognitive-motivational changes. One action research study found that using self-correction and conferencing to supplement teacher written feedback improved the quality of students' written compositions and increased motivation and confidence in writing English as a second language (Mikume and Oyoo, 2010). Another qualitative study found that students who identify with the school's academic culture were more motivated to achieve and experience higher educational gains (Honora, 2003). This could be moderated based on students' gender and achievement level, positive or negative identification with the school and their perceptions of teacher feedback, support and accessibility. The third study, based on a descriptive research design (Aedo and Millafilo, 2022), found that teacher feedback that fosters self-correction helped students develop metacognitive skills, allowed them to analyze their thought processes and learn more effectively. Explicit oral corrections directly addressed gaps in knowledge and helped students understand their mistakes and learn the correct form or approach. This study also found that positive reinforcement boosted student motivation by fostering a supportive atmosphere and encouraging engagement without fear of criticism. Feedback that involved the student actively (e.g., self-correction) made the process collaborative and increased their sense of ownership and intrinsic motivation.

TABLE 5 Overview of the included small-scale studies on students' cognitive, emotional, and behavioral outcome of teacher feedback.

Record	Reference	Country	Sample	Design	Outcome—Main findings	Moderator
2	Aedo and Millafilo (2022) C,E,B	Chile	20, (age 11–12), 6th graders, English as a foreign language	Descriptive research design	Self-correcting feedback enhances motivation but affects emotions based on tone and timing. Immediate correction may stress younger learners; delayed correction reduces engagement anxiety. Positive feedback boosts participation, while critical feedback lowers engagement	Supportive feedback reduces anxiety, while harsh delivery can harm wellbeing. Positive feedback fosters participation and communication
4	Bansilal et al. (2010) C	South Africa	5, 9th graders, Mathematics	Explorative: Naturalistic, qualitative, interpretive, case study design	Teacher feedback might build or break self-confidence	Teacher feedback style
5	Bardine (1999) C,E,B	USA	12 (age 15–16) Sophomore, Honor English class	Multiple qualitative methods design	Clear, positive feedback builds confidence, encourages participation, and supports revision. It validates effort and helps students replicate successful strategies	Clear, actionable written feedback balances praise and criticism, reinforcing effort and progress. Constructive feedback builds resilience and supports revision. Tone, clarity, and depth are key
15	Cowie (2005b) C	New Zealand	106, 7th–10th graders (10 classes), Science, 10 teachers	Sequential qualitative design	Influenced students' self-perception as competent knowers of science, and engagement with learning	The level of trust and respect in teacher-student interactions, the social dynamics of the classroom, and self-perception and identity: beliefs about learning and identification with school culture affected engagement with feedback
17	Dang (2021) C	Vietnam	31, (age 16), 10th graders	Mixed methods research design	Students' perceptions of their engagement in a correcting process increased understanding (accuracy improvement) and learning motivation	A collaborative correcting process incorporating teacher mediation and peer collaboration led to positive student cognitive outcomes. Student engagement is the most important variable contributing to students' learning outcomes
21	Fergus and Petrick Smith (2022) C,E,B	USA	5 (age 12–13), self-identified math anxiety	Multiple Case Study Design	Clear feedback, learning objectives, and reassessment opportunities reduce math anxiety and build confidence. Reassessment motivates active learning and improved understanding	Teaching practices, parental beliefs, cognitive skills, and self-efficacy shape math outcomes. Clear, actionable feedback boosts confidence and reduces frustration. Teachers focus on individual growth, avoid comparisons, and offer choices in tasks
23	Gamlem and Smith (2013) C,E,B	Norway	150 (age 13–15), 8th–10th, ($n = 11$, interviews)	Qualitative research design, observation and interview	Clear, actionable feedback fosters competence and motivation, while unclear or critical feedback creates anxiety. Supportive environments boost engagement, and peer feedback encourages cooperation	Classroom climate and clear, actionable feedback shape emotional responses and motivation. Timing, framing, and alignment with learning goals influence engagement and practical application
32	Honora (2003) C,E,B	USA	16, 9th graders (higher- and lower-achieving students)	Comparative qualitative research design	Students connected to school culture show higher motivation and achievement. Lower-achieving students, feeling unsupported, view school as restrictive, leading to disengagement and reduced help-seeking	Students' identification with school depends on teacher feedback, support, and accessibility. Lack of support fosters alienation and disidentification. Perceived unfairness and inconsistent behavior create distrust, affecting emotional engagement
36	Kerr (2017) C,E,B	United Kingdom	4 (age 13–14), high achieving, History	Multiple Case Study Design	Students prefer dialogue for feedback, linking positive emotions to increased motivation. Teacher stress or peer judgment can deter students from seeking clarity. Classroom atmosphere impacts feedback behaviors	Emotion, atmosphere, and expectations affect the feedback process. Clear, dialogic feedback boosts confidence and understanding. Teacher stress influences students' emotional states and willingness to ask questions. Peer dynamics and classroom atmosphere shape task avoidance and help-seeking behavior

(Continued)

TABLE 5 (Continued)

Record	Reference	Country	Sample	Design	Outcome—Main findings	Moderator
45	Lefroy (2020) C,E,B	United Kingdom	38 (age 14–15), high-achieving English	Qualitative Case Study Design	Audio feedback boosts resilience, participation, and motivation in learning English by fostering support and collaboration. Its informal, conversational tone reduces stress and builds trust. While audio feedback encourages active learning and applying advice, some students prefer written feedback for its clarity and ease of reference	With its empathetic tone, audio feedback fosters a trusting teacher-student relationship, making students feel supported and confident. Detailed and clear audio feedback reduces anxiety and encourages improvement. Some prefer written feedback for clarity and to avoid misinterpretation, while the supportive tone of audio helps students handle criticism and become more resilient
46	Luan and Ishak (2018) C,E,B	Malaysia	12 (age 13), second language, writing	Quasi-experimental design	Written corrective feedback boosts writing skills, with mixed reactions. Indirect feedback fosters independence, while direct feedback is clear but sometimes limiting. Over-relying on corrections can lead to passive learning, while scaffolding supports development	Students' reactions to feedback depend on its clarity, alignment with expectations, and required effort. Indirect feedback can cause frustration but fosters persistence and collaboration. The type of feedback and scaffolding influence learning strategies and engagement
51	McLaughlin (1992) C	USA	5 (age 10–11), behaviorally disordered, reading performance	Quasi-experimental pre-post-test design	Improved the accuracy of reading performance, and favorable attitude toward the written feedback process	Providing positive written comments on reading assignments each day; contingent upon improved performance, maintaining high outcomes, students worked hard/was attentive
52	Mikume and Oyoo (2010) C	Tanzania	4 (age 10), English Second Language	Action research design (longitudinal)	Improved quality of students' written compositions and increased motivation and confidence in writing	Using self-correction and conferencing to supplement teacher written feedback
54	Murtagh (2014) C	United Kingdom	12 (age 10–11), Literacy, two teachers	Cross-sectional Case Study	Activation of beliefs about learning, knowledge, and learning process: understanding of learning objectives, self-regulation, improvement in specific literacy skills (grammar, punctuation, writing style)	Student engagement with feedback. Classroom culture. Type and quality of feedback provided by teachers during literacy lessons: Descriptive feedback, modeling and examples
62	Rathel et al. (2014) B	USA	4 (age 6, 10, 12, 13), Special education; Serving students with mild disabilities, four teachers	The study used a multiple baseline design across four teachers	Improvement in Task Engagement. Students' task engagement levels were closely linked to teachers' positive-to-negative communication ratios	Primarily attributed to changes in teachers' communication behaviors, specifically the increased ratio of positive-to-negative communication behaviors and the use of behavior-specific praise
65	Ruthmann (2008) C	USA	16 (age 10–11), Music Technology, one teacher	Case study, multifaceted qualitative approach	Development of musical knowledge, creative expression, reflective and metacognitive skills, and problem-solving skills	Teacher feedback style, respect for student agency, negotiation of creative intent, classroom environment, pedagogical design of composing experiences in music education
79	Sutherland et al. (2000) B	USA	9, (age 10–11), 5th grade, one teacher	An ABAB withdrawal design, (single-case experimental design)	Students' on-task behavior consistently improved during the intervention phases when the teacher's behavior-specific praise (BSPS) increased	Teacher's increased use of behavior-specific praise (BSPS). Positive reinforcement, clarity of expectations, and consistent teacher practice of BSPS were included
81	Tan et al. (2019) C	Australia	32 (age 14–15), 9th grade	Qualitative research design, interview	Increased knowledge and understanding of metacognition (knowledge and regulation of cognition)	Build on Self-Determination Theory. In addition to asking thought-provoking and open-ended questions, use attentive listening
83	Tay and Kee (2019) C,E,B	Singapore	6, (age 10–14) students with high-functioning autism spectrum disorder (ASD), six teachers	Instrumental case study	Feedback enhances focus, engagement, and understanding, reducing anxiety. It boosts comfort in social interactions and increases participation, focus, and task completion	Clear guidance, extended wait time, visual support, and affirmative feedback create a supportive environment. Tailored feedback helps manage emotional pressures, while thoughtful strategies improve outcomes

(Continued)

TABLE 5 (Continued)

Record	Reference	Country	Sample	Design	Outcome—Main findings	Moderator
85	Torkildsen and Erickson (2016) C, E	Sweden	29 + 25, five to nine graders	Action research design: focus group interview and dialogical meeting	Students prefer specific, timely, clear, and actionable feedback with opportunities to revise and improve. General praise might be frustrating, while a lack of feedback is demotivating or confusing. Sometimes the language used in feedback is a challenge	Students' perceptions of teacher feedback
86	Van der Kleij (2023) C	Australia	7 students (age 13–14) in two classrooms: English and Mathematics. Two teachers	Case study design: Video-stimulated recall interviews	Discrepancies in teachers' and students' perceptions of feedback. Students saw questions as attention checks, causing embarrassment. Students saw themselves as feedback recipients rather than active participants. Students' emotional reactions to feedback significantly influenced their engagement	Dialogic feedback: Teachers used questions to foster thinking and inclusivity and emphasised reformulating responses
87	Van Der Kleij and Adie (2020) C, E	Australia	7 students (age 13–14) in two classrooms: English and Mathematics. Two teachers	Case study design: Video-stimulated recall interviews	Over 30% of the feedback went unrecognised by students. Math feedback was more often correctly understood than English, likely due to its factual nature. Students preferred clear, corrective explanations over open, discussion-based feedback. Dialogic feedback had mixed effectiveness	Students' perceptions of teacher feedback. Students' background knowledge, confidence, feelings, and personal beliefs shaped how they receive and interpret feedback

Letters in bold indicate the coding of the study, respectively cognitive (C), emotional (E), and behavioral (B) outcome.

Two studies found the activation of students' beliefs about learning by the provisions of teacher feedback ([Fergus and Petrick Smith, 2022](#); [Murtagh, 2014](#)). One of these studies, a Multiple Case Study Design, found that math-anxious students can benefit from effective feedback and clear learning objectives ([Fergus and Petrick Smith, 2022](#)). This study emphasized that especially three main factors were moderators. These were environmental factors: teacher's instructional practice, parental attitudes and beliefs in their child's math ability. Intellectual factors: Cognitive abilities and spatial reasoning skills, and personal factors: Self-efficacy and attitudes toward mathematics. The other study, a cross-sectional case study, investigated students' experiences of teacher feedback and found that it could enhance students' activation of beliefs about learning, knowledge, and the learning process ([Murtagh, 2014](#)). These improvements included understanding of learning objectives, self-regulation, and specific literacy skills (grammar, punctuation, writing style).

Two studies emphasize students' preferences for dialogic feedback interactions ([Gamlem and Smith, 2013](#); [Kerr, 2017](#)). One small-scale qualitative study found that students' preferences for teacher feedback were dialogic feedback interactions that support their perceptions of learning and understanding ([Gamlem and Smith, 2013](#)). The participating students explained that the classroom climate, including honesty and objective feedback, is essential for the uptake. In addition, the teacher's feedback practice of providing opportunities and time to apply feedback, feedback type, and information about assessment criteria becomes central to students' perceptions of the quality of this feedback. The second multi-case study found that students prefer dialogue with the teacher, where the students can seek clarity through verbal feedback ([Kerr, 2017](#)). This study emphasized that variables like emotion, atmosphere, and expectations impacted the feedback process.

Two studies found how teacher feedback can strengthen students' perceptions of self-confidence ([Bansilal et al., 2010](#); [Bardine, 1999](#)). One of these studies, an explorative naturalistic case study design in mathematics, found that students perceived teachers' assessment feedback as important in scaffolding their learning process and the teachers' feedback as instrumental in either building or breaking their self-confidence ([Bansilal et al., 2010](#)). The effect the feedback may have in building or breaking a student's self-confidence emphasizes the need for educators to provide constructive feedback that focuses on students' progress while avoiding derogatory comments that harm self-esteem. Another study, built on a multiple qualitative methods design, examined students' perceptions of written teacher comments on their papers and found that the teachers' feedback empowered students' self-confidence and encouraged active participation in learning tasks ([Bardine, 1999](#)). This study emphasized that the teachers' written feedback was clear, descriptive, and actionable and that the teachers managed to balance between praise and criticism. In addition, the students were given opportunities for revision and redrafting, and the teacher's tone and attitude were perceived as supporting. Similar results were found in an action research study ([Torkildsen and Erickson, 2016](#)). They found that students prefer specific, timely, clear, and actionable feedback with opportunities to revise and improve. General praise might be frustrating, while a lack of feedback is demotivating or confusing.

Two case studies focusing on classroom interactions and dialogues, probably based on the same data material, found that teachers and students often perceive feedback differently and that students do not always understand teachers' intentions ([Van Der Kleij and Adie, 2020](#); [Van der Kleij, 2023](#)). Over 30% of the feedback went unrecognised by students. Math feedback was more often correctly understood than English feedback, likely due to its factual nature. Students often saw teachers' questioning as attention checks and themselves as feedback recipients rather than active

participants. Students preferred clear, corrective explanations over open, discussion-based feedback.

Finally, three studies on teachers' feedback and students' engagement are found (Cowie, 2005b; Dang, 2021; Lefroy, 2020). One study, a sequential qualitative design in science, found that teacher feedback influenced students' self-perception as competent knowers of science and engagement with learning (Cowie, 2005b). This study revealed that the level of trust and respect in teacher-student interactions was essential for students' engagement and classroom social dynamics. Regarding students' self-perception and identity, this study found that students' beliefs about learning and identification with school culture affected engagement with feedback. Another study, a mixed methods research design, found that students' engagement with teacher feedback in a correcting process increased understanding (accuracy improvement) and increased learning motivation (Dang, 2021). This study found that the collaborative correcting process, incorporating teacher mediation and peer collaboration, led to positive student cognitive outcomes. In addition, it was emphasized that student engagement with teacher feedback was the most crucial variable contributing to students' learning outcomes. A third study, with a qualitative case study design with a sample of high-achieving English students, found that teachers' audio feedback and overwritten feedback enhanced students' resilience and active participation in learning English (Lefroy, 2020). The students explained that a sense of being valued, in addition to a positive and trusting relationship between teacher and student, was important for their value of the type of teacher feedback.

3.2.4 Brief summary of the findings concerning feedback and cognitive outcome

Overall, the review of the studies on cognitive outcomes indicates that teacher feedback can influence students' motivation and learning in several ways. Process-oriented and individualized feedback appears to strengthen students' competency-based motivation, such as self-efficacy and control beliefs. Clear, detailed, and actionable feedback can increase students' interest and positive attitudes toward learning. Self-referenced feedback (focusing on one's development) increases students' confidence more than norm-referenced feedback (compared with others/grades). Feedback tailored to goal orientation may shape learning preferences, with positive feedback promoting mastery goals and negative feedback increasing avoidance tendencies. In general, harsh critique and negative feedback destroy students' motivation and engagement. Most students prefer direct, constructive, and actionable feedback. Teacher engagement in the feedback appears to be important for student engagement and follow-up on feedback, as is trust and respect in the relationship between student and teacher. Dialogic feedback can also increase student engagement and is considered helpful for clarifying and elaborating the feedback message and increasing students' understanding. Feedback may also indirectly influence the classroom climate through student's behavior. Gender, achievement level, and student perceptions may impact students' uptake and outcome of feedback. Finally, students and teachers may sometimes perceive the quality of feedback differently.

3.3 Teacher feedback and emotional outcome

3.3.1 Teacher feedback and emotional outcome in intervention studies

Only four of the intervention studies present explicit emotional outcomes. One study (De Meester et al., 2020) shows that including positive comments in corrective feedback can reduce students' frustrations. Another study shows that the pupils enjoyed improved assessment practice with explicit criteria, rewards, more student activity, dialogue and interaction (Ozan and Kincal, 2018). The third study found that strengthened grammar feedback with error codes and explanations in English foreign language was associated with increased students' emotional engagement (Santanatanon and Chinokul, 2022). The last study found that a positive approach to error handling, like learning from errors, led to a more trustful classroom climate and reduced students' level of anxiety (Sokmen, 2021). Although the number of studies is limited, the findings are consistent with previous research and various motivation theories.

3.3.2 Teacher feedback and emotional outcome in observational studies

Twelve of the observational studies reported findings related to emotions. Most of these reported emotions as an outcome of a specific feedback type. Frequent feedback (Chi et al., 2021), positive general feedback (Koka and Hein, 2003), and praise and increased attention (Nicaise et al., 2007) were found to be positively associated with students' enjoyment. Conversely, criticism was negatively associated with students' enjoyment (Nicaise et al., 2007) and positively related to negative emotions (Zumbrunn et al., 2016). Constructive feedback (Harris et al., 2014) and positive comments (Oinas et al., 2021) were positively associated with positive emotions in students, while one study found that process feedback and goal clarification were negatively associated with need frustration (Krijgsman et al., 2019). Building on self-determination theory, one study suggests that autonomy, competence, and relatedness are mediators between corrective feedback and students' wellbeing (Vergara-Torres et al., 2021). Another study found that positive emotions were most frequent when students received feedback but that various emotions were at play, such as hope and calm (Lui and Andrade, 2022). Moreover, the same study found that positive emotions were positively related to favorable judgement of the feedback (e.g., the meaningfulness). One study found that the emotional outcome of the feedback was related to under- and overestimation of competence (Jang et al., 2015). If the student overestimated their competence, the feedback could cause negative emotions such as frustration, while the opposite could cause positive emotions like surprise and pride. Finally, positive feedback, like praise (Cunha et al., 2019) and clear and understandable feedback (Sokmen, 2021), was related to increased emotional engagement.

3.3.3 Teacher feedback and emotional outcome in small-scale studies

Eleven small-scale studies explored the relationship between teacher feedback and students' emotional responses. Across the

eleven studies (Aedo and Millafilo, 2022; Bardine, 1999; Fergus and Petrick Smith, 2022; Gamlem and Smith, 2013; Honora, 2003; Kerr, 2017; Lefroy, 2020; Luan and Ishak, 2018; Tay and Kee, 2019; Torkildsen and Erickson, 2016; Van Der Kleij and Adie, 2020), teacher feedback emerges as a multifaceted tool influencing students' emotional outcomes. Most of the studies reported several emotional outcomes. Thus, this text presents representative themes with integrated findings from the nine studies, providing a cohesive overview of emotional outcomes and their underlying causes.

Five studies demonstrate that clarity and specificity of feedback are fundamental to students' emotional responses to feedback and that clear, detailed feedback promotes confidence (Bardine, 1999; Fergus and Petrick Smith, 2022; Gamlem and Smith, 2013; Lefroy, 2020; Luan and Ishak, 2018). One study highlights how ambiguous comments frustrate students, while detailed feedback fosters trust and confidence (Bardine, 1999). Similarly, two studies (Fergus and Petrick Smith, 2022; Gamlem and Smith, 2013) demonstrate that actionable feedback alleviates anxiety and reassures students about their abilities. One study found that while audio feedback can be motivating due to its relational tone, unclear messages can increase stress (Lefroy, 2020). Finally, one study found that direct feedback instills confidence but may sometimes undermine independent thought (Luan and Ishak, 2018).

Four studies found that positive vs. negative feedback is an essential theme for students' emotional outcomes (Aedo and Millafilo, 2022; Bardine, 1999; Gamlem and Smith, 2013; Luan and Ishak, 2018). The tone and framing of feedback significantly influence students' emotional states. Positive and supportive teacher feedback reduces anxiety, as seen in Aedo and Millafilo (2022), where non-threatening feedback fosters positive emotions. One study found that specific praise validates effort, boosting motivation (Bardine, 1999), while another indicates that constructive feedback enhances competence (Gamlem and Smith, 2013). Conversely, as noted in Aedo and Millafilo (2022), Gamlem and Smith (2013), Luan and Ishak (2018), harsh or overly critical comments lead to frustration or discouragement, emphasizing the need for a constructive approach.

Five studies demonstrate that feedback's timing and delivery method affects how students process and respond to it (Aedo and Millafilo, 2022; Kerr, 2017; Lefroy, 2020; Luan and Ishak, 2018; Torkildsen and Erickson, 2016). Immediate feedback can increase stress, especially for younger learners, as indicated in Aedo and Millafilo (2022). Students' mood and readiness influence their receptiveness to teacher feedback, with one-to-one sessions reducing anxiety (Kerr, 2017). Audio feedback is often appreciated for its personal touch but may overwhelm students compared to written feedback (Lefroy, 2020). Timing and effort required to decode indirect feedback initially frustrate students but lead to satisfaction upon mastery (Luan and Ishak, 2018).

Three studies found that trust and emotional safety in the classroom are pivotal in shaping students' emotional responses (Gamlem and Smith, 2013; Honora, 2003; Lefroy, 2020). Studies show that a trusting teacher-student relationship fosters receptiveness to feedback, while distrust undermines this (Gamlem and Smith, 2013; Lefroy, 2020). One study underscores how a lack of teacher support or perceived differential treatment contributes to alienation and distrust, particularly among lower-achieving students (Honora, 2003).

Three studies demonstrate that students' emotional states and engagement readiness significantly influence feedback's impact (Kerr, 2017; Luan and Ishak, 2018; Van Der Kleij and Adie, 2020). One study highlights how personal stressors or a poor mood can block feedback processing, emphasizing the need for emotional readiness (Kerr, 2017). Similarly, another study suggests that alignment with students' expectations about feedback determines whether the response is positive or negative (Luan and Ishak, 2018).

Two studies found that perceived effort and self-appraisal are outcomes based on teacher feedback (Honora, 2003; Luan and Ishak, 2018). Feedback that challenges students' effort or supports self-appraisal elicits mixed emotional responses. One study shows how lower-achieving students often associate their worth with compliance rather than academic success, leading to disengagement (Honora, 2003). Another study found that students express frustration with indirect feedback but later report pride and satisfaction upon mastering its challenges, highlighting the importance of balancing effort and guidance (Luan and Ishak, 2018).

Two studies demonstrate that affirmative feedback reduces anxiety and fosters engagement (Fergus and Petrick Smith, 2022; Tay and Kee, 2019). One study demonstrates that specific feedback and reassessment opportunities reduce math anxiety by shifting focus from grades to mastery (Fergus and Petrick Smith, 2022). Another study emphasizes how affirming feedback, such as verbal praise or physical gestures, creates a safe environment that reduces stress and fosters confidence (Tay and Kee, 2019).

Finally, two studies demonstrate that feedback that integrates relational and social dynamics positively impacts students' emotional responses (Kerr, 2017; Lefroy, 2020). Audio feedback might strengthen motivation through its empathetic tone (Lefroy, 2020), while the value of informal feedback sessions in reducing intimidation and enhancing engagement (Kerr, 2017). Overly formal settings can create barriers, and thus, suggestions for a need for balance are argued for (Kerr, 2017).

3.3.4 Brief summary of the findings concerning feedback and emotional outcome

Teacher feedback significantly influences students' emotional outcomes, shaping confidence, engagement, and anxiety levels. Intervention studies highlight that positive comments reduce frustration, clear assessment criteria improve emotional engagement, and a constructive approach to errors fosters a supportive classroom climate. Observational studies find frequent, clear, and encouraging feedback enhances enjoyment, while criticism leads to negative emotions. Self-perception plays a role, with overestimated competence leading to frustration and underestimated competence fostering positive emotions. Small-scale studies emphasize the importance of clarity, tone, and timing in feedback delivery. Clear and actionable feedback builds confidence, while harsh or ambiguous feedback can cause stress. Trust in teacher-student relationships and an emotionally safe environment increase receptiveness to feedback. Personalized and relational feedback, including audio and informal sessions, can boost motivation and engagement. Ultimately, constructive and

empathetic feedback fosters emotional wellbeing, while negative or unclear feedback risks alienation and disengagement.

3.4 Teacher feedback and behavioral outcome

3.4.1 Teacher feedback and behavioral outcome in intervention studies

Six of the intervention studies reported some form of behavioral outcome, and all these studies are previously mentioned in Section 2.1 and some in Section 3.1. Three of the studies reported increased engagement/behavioral engagement. In one study, the increased engagement was related to a comprehensive intervention to change students' beliefs about feedback (Sandal et al., 2022). In another study, engagement change was related to strengthened grammar feedback using error codes and explanations in English foreign language learning (Santanatanon and Chinokul, 2022). Lastly, one study found that feedback technology in the classroom, a handheld device for direct communication with the teacher, temporarily increased students' engagement (Wiggins et al., 2017).

Two studies reported improved strategic learning behavior. One study found increased self-regulated learning due to an intervention focusing on goals and criteria, increased student inquiry and dialogue, and specific tailored progress feedback (Ozan and Kincal, 2018). Another study found an increased use of reading strategies after feedback on reading strategy utility with fading overt verbalization (Schunk and Rice, 1993). In addition to these studies, a study tested three types of rubrics in science education and found that the most comprehensive rubric increased students' performance in planning experiments (Wollenschläger et al., 2016).

3.4.2 Teacher feedback and behavioral outcome in observational studies

Twenty-three observational studies reported some form of behavioral outcome; most studies are already mentioned in the previous sections (see Table 4). However, in this section, we will highlight these studies' behavioral aspects, hopefully without repeating too much information. We will start with six studies that report associations between teacher feedback and students' behavioral engagement and actions. In one study (Cunha et al., 2019), the researchers found that regular checking of homework combined with positive feedback increased students' homework engagement and effort. Similar results were reported in another study that found that teachers' homework engagement predicted homework effort and completion (Xu et al., 2022). A longitudinal study (Mak, 2019) found that an improved feedback practice, including clear criteria before, constructive input during, and reflection after writing assignments, increased students' engagement in writing. A fourth study found a positive relationship between clear, comprehensible, and constructive feedback and behavioral engagement (Sokmen, 2021), while a fifth study found that feed-forward enhanced students' engagement both directly and indirectly through growth goal setting (Martin et al., 2022). Finally, one study found that students' task value consideration influenced

their actions on feedback (Lui and Andrade, 2022). Together, these studies highlight some properties of teacher feedback that hopefully can promote students' behavioral engagement. Conversely, a study found that a lack of understanding of the feedback message can lead to students not following up on feedback (Burner, 2016), and another study outlines that students' inclination to act on the feedback sometimes depends on trust in the teacher-student relationship (Cowie, 2005a). Finally, one study found that teachers' praise increased students' efforts in physical education, while criticism reduced their performance (Nicaise et al., 2007). These are aspects that may be worth taking note of.

We have previously presented findings indicating that girls and boys may perceive teacher feedback differently. A study thus finds that girls and boys also may act differently (Guo, 2021). In the setting of scaffolding feedback (hints or clues to help students arrive at the correct answers independently), male students reported higher use of critical thinking strategies. In comparison, females reported higher use of self-resource management strategies. This leads us to teacher feedback's function in relation to self-regulated learning.

Seven other studies report outcomes related to students' strategic learning. One study found that students' positive feedback perceptions promoted their use of self-regulation strategies in the context of science learning (He et al., 2023). Another study considered students' feedback perceptions as a mediator between self-efficacy and self-regulation in the context of writing (Zumbrunn et al., 2016). A third study found that comprehensive feedback targeting the task, process, and self-regulation level enhanced students' use of learning strategies and facilitated positive classroom behavior (Monteiro et al., 2021). Moreover, a fourth study reported that students found timely, detailed feedback most valuable for revising assignments and planning future strategies (Sewagegn and Dessie, 2020). Two studies found that regular homework reviews by the teacher with tailored and constructive feedback enhanced students' self-regulation (time management, deep learning strategies) and homework performance (Nunez et al., 2015; Tas et al., 2016). Finally, one study emphasized that two-way feedback could empower students to develop self-regulation skills (Tan et al., 2019).

Finally, we have five studies that are not so easy to categorize. One study reported that actionable feedback drove improvement, while success criteria checklists can enhance students' feedback processing (Tay and Lam, 2022). Another study found that the quantity of homework feedback predicts self-regulation and approval-seeking, while the quality of the feedback predicts students' motivation and purposes (Xu, 2022). One study found that the constructs of self-determination theory, autonomy, competence, and relatedness were mediators between corrective feedback and students' energy and enthusiasm (Vergara-Torres et al., 2021). Another study pointed out that technology-enhanced feedback may not contribute to students' self-regulation but rather make them externally regulated (Oinas et al., 2021). Finally, we would like to mention a large-scale study that found that systematic use of positive teacher feedback was associated with lower suspension rates across 1,500 classrooms (Scott and Gage, 2020).

3.4.3 Teacher feedback and behavioral outcome in small-scale studies

In total, 11 small-scale studies explored the relationship between teacher feedback and students' behavioral responses (Aedo and Millafilo, 2022; Bardine, 1999; Fergus and Petrick Smith, 2022; Gamlem and Smith, 2013; Honora, 2003; Kerr, 2017; Lefroy, 2020; Luan and Ishak, 2018; Rathel et al., 2014; Sutherland et al., 2000; Tay and Kee, 2019). These studies found a variety of student behavioral outcomes such as engagement and participation, emotional and social impact, task completion and focus, gender, and individual differences.

Six studies found that positive and constructive teacher feedback plays a crucial role in fostering active participation and engagement among students (Aedo and Millafilo, 2022; Bardine, 1999; Fergus and Petrick Smith, 2022; Gamlem and Smith, 2013; Lefroy, 2020; Tay and Kee, 2019). Two studies demonstrate that actionable and encouraging feedback enhances classroom participation, risk-taking, and a willingness to engage with tasks (Aedo and Millafilo, 2022; Bardine, 1999). Similarly, one study highlights how formative assessments promote self-assessment and active learning (Fergus and Petrick Smith, 2022), while another study shows that useful teacher feedback encourages task revision and deeper involvement in learning activities (Gamlem and Smith, 2013). Feedback provided in dynamic formats, such as audio feedback (Lefroy, 2020) and strategies tailored to students' interests (Tay and Kee, 2019), further strengthened participation and engagement. However, studies warn that negative or judgmental feedback can lead to avoidance and reduced classroom effort (Aedo and Millafilo, 2022; Gamlem and Smith, 2013).

Five studies demonstrate that the format and clarity of teacher feedback significantly shape students' behavioral responses (Bardine, 1999; Lefroy, 2020; Luan and Ishak, 2018; Rathel et al., 2014; Sutherland et al., 2000). One study found that clear, specific, and actionable feedback helps students effectively revise their work and understand expectations—and conversely, vague or ambiguous feedback can lead to task avoidance and superficial edits (Bardine, 1999). One study highlights that audio feedback encourages students' active engagement and resilience (Lefroy, 2020), whereas another study found that written feedback supports structured revisions for students who prefer clarity (Luan and Ishak, 2018). Two studies demonstrate how well-defined guidance improves task engagement and focus using behavioral-specific praise (Rathel et al., 2014; Sutherland et al., 2000). These findings indicate that teacher feedback's actionable nature and format directly influence how students respond and engage.

Six studies demonstrate that teacher feedback profoundly impacts students' emotional and social behaviors (Aedo and Millafilo, 2022; Gamlem and Smith, 2013; Honora, 2003; Kerr, 2017; Lefroy, 2020; Luan and Ishak, 2018). One study found that positive and empathetic feedback fosters resilience and trust (Lefroy, 2020), while three studies demonstrate that judgmental or overly critical feedback reduces engagement (Aedo and Millafilo, 2022; Gamlem and Smith, 2013; Honora, 2003). One study found that teachers' facilitation of peer feedback encourages collaboration and mutual support when framed constructively, though overly cautious feedback can hinder its effectiveness (Gamlem and Smith, 2013). One study demonstrates that scaffolding and teacher modeling nurture proactive learning behaviors (Luan and Ishak,

2018). However, trust issues or negative perceptions of teacher actions can reduce help-seeking behavior and limit academic engagement, underscoring the importance of supportive and non-judgmental feedback practices (Honora, 2003; Kerr, 2017).

Three studies demonstrate that students' ability to stay on task and complete assignments is closely tied to clear guidance and structured interventions (Rathel et al., 2014; Sutherland et al., 2000; Tay and Kee, 2019). Two studies highlight the importance of behavioral-specific praise in improving on-task behavior, particularly among students with emotional and behavioral challenges (Rathel et al., 2014; Sutherland et al., 2000). One study found that interest-based learning and tailored strategies further support students' task retention and focus by aligning instructional activities with students' preferences (Tay and Kee, 2019).

Three studies demonstrate that students' behavioral responses to teacher feedback are moderated by gender and individual preferences (Honora, 2003; Kerr, 2017; Luan and Ishak, 2018). One study reveals that boys often engage socially rather than academically, while girls focus more on academic outcomes (Honora, 2003). One study found that feedback preferences, such as direct or indirect, also impact engagement, with some students thriving on explicit corrections. In contrast, others prefer indirect feedback that fosters independent problem-solving (Luan and Ishak, 2018). One study demonstrates that classroom dynamics and peer expectations further shape responses, with students avoiding help-seeking behaviors in less supportive environments (Kerr, 2017).

3.4.4 Brief summary of the findings concerning feedback and behavioral outcomes

Intervention studies show comprehensive feedback interventions, grammar feedback, and classroom technology can enhance behavioral engagement, while strategic feedback improves learning behaviors like self-regulation and students' use of reading strategies. Observational studies highlight regular homework checks, clear feedback, and praise boost behavioral engagement, while unclear feedback and lack of trust prevent students from effectively applying feedback. Gender differences emerge; for instance, boys seem to use more critical thinking strategies, and girls focus on self-management based on the same feedback. Small-scale studies confirm that clear, positive, and actionable feedback fosters participation, while judgmental feedback discourages engagement. Audio and written feedback formats form students' responses, with structured feedback aiding focus and revision. Trust and empathetic feedback enhance resilience, while critical feedback reduces help-seeking behavior. Task retention improves with behavioral-specific praise and interest-based strategies, though engagement varies by gender and individual preferences. Ultimately, constructive and tailored feedback supports student engagement, learning behaviors, and classroom participation.

4 Discussion

The purpose of this review study was to systematize and synthesize empirical research related to students' outcomes from

teacher feedback for the age group 10 to 16. In what follows, we will answer the research questions and address some aspects of the results that we think are worth noting.

4.1 What student outcomes are measured in studies concerning teacher feedback?

The review of the included studies shows that many different student outcomes have been investigated, as well as many other features of feedback that cannot necessarily be described as student outcomes. We have chosen to focus on achievement, cognitive, emotional and behavioral outcomes because these cover central processes and activities in student learning. Nevertheless, we acknowledge that this perspective and this categorization may have meant that we have not covered all types of outcomes.

In the studies in this review, achievement is measured in the form of average academic grades, grades in individual subjects, performance on the PISA test, writing skills, improvement on assignments, tests or assignments adapted to the specific research setting, and other student products like a welding result. Most studies use ecological measurements (measurement in a natural setting) of achievement, something we find reassuring and which strengthens the validity of the findings. Furthermore, it is also positive that most studies report significant correlations between feedback and achievement, which strengthens the assumption that teacher feedback actually impacts students' learning and academic performance. However, potential publication bias remains uncertain, as non-significant or negative findings may be underrepresented.

The review reveals that the existing research measures several cognitive components of teacher feedback, most commonly motivational factors like self-efficacy (Bandura, 1997), self-concept, task value, interest (Wigfield and Eccles, 2000), engagement (Fredricks, 2011; Marks, 2000), goal orientation (Elliot and Hulleman, 2017; Pintrich, 2000) and concepts in self-determination theory such as autonomy, competence, relatedness, and intrinsic motivation (Ryan and Deci, 2017).

Studies also examine students' beliefs about feedback (e.g., Lee, 2021; Pat-El et al., 2015; Sandal et al., 2022), critical thinking (Hitchcock, 2020), and preferences for feedback (e.g., Brooks et al., 2019; Gamlem and Smith, 2013; Kerr, 2017; Tan et al., 2019). Some studies also test a number of cognitive components as potential mediators or moderators in larger models without necessarily having a solid theoretical basis, highlighting the cognitive complexity of feedback situations. Some phenomena on which there is more limited research are students' cognitive processing and metacognition (Dunlosky and Metcalfe, 2008) related to feedback and how different personality characteristics may affect students' uptake and processing of feedback (e.g., Guo, 2021; Van der Kleij, 2019). An interesting focus area in this regard is the emerging research on internal feedback, which concerns how students generate internal feedback by comparing their current knowledge against some reference information (Nicol, 2020; Laudel and Narciss, 2023).

A limited number of studies include emotional components in their investigations. Most research is conducted on common academic emotions (Pekrun, 2024), like anxiety, frustration, pride, enjoyment, surprise or, more generally, positive and negative emotions, and wellbeing. Moreover, most of these studies examine emotions or affective factors as outcomes of feedback. However, among the included studies, we also find affective components related to social relations (e.g., Gamlem and Smith, 2013; Kerr, 2017; Lefroy, 2020), typically the relation between student and teacher, which points out that concepts like trust and respect might affect the student outcome, although these concepts also contain cognitive aspects. Finally, some studies see emotional states, for instance, mood, as a kind of filter for feedback. It typically affects students' receptiveness and can, therefore, be regarded as a moderator. Nevertheless, there is still little research on the emotional aspects of feedback, and we, therefore, need more studies that integrate what we know about students' emotions in education (e.g., Pekrun, 2024) with what is special for feedback situations (e.g., Lipnevich et al., 2021).

The most common behavioral outcome is engagement, often seen as a key mediator between feedback and learning or achievement. However, many studies lack clarity on whether engagement refers to cognitive, emotional, or behavioral aspects (Fredricks, 2011). Although these aspects of engagement are often integrated, a clarification could have been needed. Other common measured behavioral outcomes are processes related to students' self-regulated learning (Pintrich, 2000). This is often students' use of various learning strategies or more general processes such as planning, time management or effort regulation. A weakness of these results, however, is that the majority of these studies are based on student self-reports. More intervention studies and studies that actually measure observed behavior should, therefore, be a goal for future research. Other behavioral outcomes identified in the studies include suspension rates from school, classroom behavior, help-seeking, social behavior, and effort related to specific learning activities such as revising writings or completing assignments.

4.2 What factors are assumed to moderate students' outcomes of teacher feedback?

The most significant group of moderators of students' feedback outcome is related to the form and content of the feedback given. Teacher feedback can vary along several dimensions: its individualization, comprehensiveness, clarity, and whether it is constructive, judgmental, corrective, general, specific, positive, negative, direct, indirect, or action-oriented. Additionally, feedback can differ by mode (oral or written), timing, and medium—such as in class, on assignments, online, or via recordings. This review highlights that effective feedback must be tailored to the learning task, context, and learner, rejecting a one-size-fits-all approach. Lastly, we mention a few conceptual models that several studies seem to use as models for improved feedback practice or developing interventions. First is the Hattie and Timperley (2007) model of feed-up, feedback, and feedforward. Feed-up clarifies learning objectives and expectations before a task, feedback assesses current performance against goals, and feedforward outlines steps

for improvement. Another model from the same article that several studies referred to was the levels of feedback model, which categorizes feedback into task, process, self-regulation, and personal levels. We acknowledge that these conceptualizations may be useful for both research and practical purposes but encourage researchers and practitioners to also draw inspiration from more recent models (e.g., Lipnevich and Panadero, 2021; Lui and Andrade, 2022; Lipnevich and Smith, 2022).

Another group of moderators is related to students' characteristics (Kelley and McLaughlin, 2011). The included studies reveal that students may perceive the same feedback differently. This might be related to what type of feedback they prefer and what feedback they like or find most useful. A number of studies also show that students' motivation, beliefs, and conceptions can influence how feedback is understood and, not least, whether feedback is followed up with action. In addition, several studies also indicate that the student's level of achievement in the subject in question can influence how students both understand and use the feedback. Finally, gender differences are highlighted as potential moderators in a few studies. However, an important question is whether the difference lies in the perception of feedback or if males and females are treated differently and receive distinct feedback. From the perspective of tailored feedback, it can be a good thing that feedback varies in form and content, but we need more research to clarify how these differences actually manifest themselves.

A third group of moderators involves social interactions and communication. Studies highlight trust, respect, and teacher engagement as key factors influencing how feedback is received and acted upon (e.g., Cowie, 2005b; Van der Kleij, 2023). Teachers and students often perceive feedback differently, with many students struggling to understand or use it effectively, partly due to unclear language or insufficient tailoring. One way to address these issues is through teacher-student dialogue. Multiple studies emphasize that opportunities for discussion are crucial for students' comprehension of feedback, as dialogue can help clarify misunderstandings and provide deeper insights. Overall, communication—both in delivering and discussing feedback—appears to be a significant moderating factor.

The fourth group of moderators that we will mention is related to the learning context, although few studies focus on this (e.g., Chang et al., 2020). However, a few studies mention that the classroom climate may affect student response and uptake of feedback. This concerns students' opportunity to feel safe and learn without fear of teasing or making a fool of themselves. Previous research on classroom goals and the collective climate for learning can thus be helpful in unpacking this (e.g., Ames, 1992; Gamlem and Munthe, 2014). In addition, this can be about structures and how feedback is given and organized.

4.3 Do the results of the studies indicate that some factors are more important than others in moderating students' various outcomes of teacher feedback?

The review of the 96 studies clearly indicates that feedback quality has the greatest potential for increasing students' outcomes

of teacher feedback. The intervention studies show that tailored, clear, informative, and action-oriented feedback positively affects student achievement. In addition, the review shows that more or less the same factors contribute to positive motivation and engagement among students. As if that's not enough, it's also the type of feedback students most want.

Some studies show that teachers are not always as clear in their feedback as they think, and many students do not always understand the feedback they receive. This indicates that feedback is also a matter of communication and that teachers must be sensitive to students' prerequisites and needs, although we recognize that this might be demanding on a busy school day. Dialogical feedback or dialogue about the feedback is pointed out as a measure to prevent such challenges.

Finally, we want to point out the negative consequences of criticism and negative feedback. Several of the studies in this review show, quite in unison, that negative feedback kills students' motivation and can lead to anxiety and avoidance behavior.

4.4 What is particular for students at ages 10–16

In this study, we have focused especially on the age group 10–16. Students in this age group are in a critical developmental stage where they are forming their academic identity, self-concept, and motivation for learning (Black and Wiliam, 1998; Eccles et al., 1993). Unlike younger children, this age group may be more self-conscious and sensitive to criticism, making them more likely to react defensively to feedback perceived as negative. At the same time, they seek autonomy and respect, so overly directive or controlling feedback can be demotivating (Ryan and Deci, 2017).

Our review reveals that effective feedback for this age group should be specific, constructive, and focused on effort and strategies rather than innate ability. It should also emphasize strategies that support self-regulated learning (Brandmo et al., 2020). Moreover, students in this age group need guidance on planning, monitoring, and evaluating their own learning processes, which means feedback should highlight effective study techniques, problem-solving approaches, and ways to overcome challenges (e.g., Chan and Lam, 2010; Ozan and Kincal, 2018; Tan et al., 2019). When framed as an opportunity for growth, feedback can enhance resilience and motivation, particularly if it fosters a sense of competence and ownership of learning.

This review emphasizes the importance of social dynamics in adolescence, highlighting the need for feedback that preserves students' sense of competence and ownership. Private, personalized feedback is often the most effective, strengthening the teacher-student relationship and fostering engagement. Public feedback should be handled carefully to avoid embarrassment. When presented as a tool for growth rather than evaluation, feedback fosters motivation and supports academic development.

4.5 Limitations and future perspectives

We have previously mentioned limitations related to using a restricted set of categories, variation in the quality of the

included studies, and the possibility of publication bias. Further, for pragmatic reasons, we have only focused on peer-reviewed articles published in English. Although peer-reviewed articles may represent the most substantial evidence, we may have missed interesting findings in doctoral dissertations and other gray literature. Moreover, because of keeping to English only, studies from the French- and Spanish-speaking populations may be underrepresented. Only three studies from South America and four from Africa were included.

Even though we have focused on a specific age group, we assume that some of the findings may also be valid for older students. This particularly applies to the quality aspects of feedback and the motivational mechanisms. Therefore, a goal in future research may be to map what is special in various groups and whether there exist more or less universal characteristics of feedback (Black and Wiliam, 2018). Further, it remains to explore how the most essential factors of feedback can be turned into sustainable classroom practices, the available resources taken into account.

In our approach to this review, we stopped when ChatGPT became publicly available. This was because we did not know how it would affect teacher feedback and the following research. After working on this study for a while, we see aspects of teacher feedback that can be replaced with chatbots. Artificial Intelligence (AI) can provide actionable feedback and process-focused guidance and efficiently deliver corrective feedback and strategy suggestions (Engeness and Gamlem, 2025; Hopfenbeck et al., 2023). However, it often lacks the emotional sensitivity and individualized encouragement necessary for student engagement. Teacher feedback, by contrast, is personalized, relational, and emotionally nuanced—key factors in student motivation and self-regulated learning. A future challenge would be finding working methods and systems where AI can be integrated into teaching and feedback in a sensible and appropriate way.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

CB: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. SG: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that Gen AI was used in the creation of this manuscript. We used the Data Analyst function in ChatGPT to extract the most significant information from each study. A PDF file of each article was uploaded to the service, after which we provided prompts to extract information. Typical prompts were “...given an overview of the study, ...what study design was used, ...main findings concerning feedback”. The information was then manually coded in a spreadsheet into four main outcome categories (achievement, cognitive, emotional, and behavioral).

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2025.1572950/full#supplementary-material>

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*refers to studies included in the review.



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Unheard and unused: why students reject teacher and peer feedback

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Background: In higher education, feedback has become a significant focus of study over the years. Despite established high-quality feedback criteria, the issue of students not utilizing feedback from instructors and peers persists. This study identifies key barriers to feedback utilization and offers insights that can inform more responsive and student-centered feedback practices.

Aims: This study investigated specific reasons behind feedback rejections in higher education and how individual characteristics (college students' gender, ethnicity, and academic level) predicted the reasons to reject teacher and peer feedback.

Methods: Undergraduate and graduate students ($N = 200$, 67.7% women) from various colleges within a large public university in the northeast of the USA were asked to describe possible reasons why they did not use feedback provided by their instructors and peers' feedback on an academic assignment. Students' responses were analyzed using a deductive approach with a coding system based on the Student-Feedback Interaction Framework.

Results: Students tend not to use or reject teacher feedback due to ambiguous or unclear messages, negative tone, lack of respect or trust in the teacher, and confidence in their performance. Peer feedback is commonly rejected because of a perceived lack of peer expertise, ambiguous messages, and negative emotional responses. Multiple logistic regressions found that gender and educational level are significant predictors of reasons for not utilizing feedback, with distinct patterns observed among male students and undergraduates.

Conclusion: This study underscores the need for feedback strategies addressing individual student characteristics and contextual factors. Recommendations include fostering positive teacher-student relationships, enhancing the clarity of feedback, and improving students' skills in peer feedback provision and utilization.

KEYWORDS

teacher feedback, peer feedback, feedback rejection, higher education, reason to not use feedback

Introduction

Over three decades of research have demonstrated that effective feedback has the potential to significantly enhance students' learning and achievement (Black and Wiliam, 2009; Hattie and Timperley, 2007; Wisniewski et al., 2020). Feedback has been defined, explored, and situated within operational models, with much of the research in instructional settings focusing on teacher-provided feedback and its informational content. However, it has become increasingly clear that delivering information alone is insufficient without opportunities for purposeful application and improvement (Nicol et al., 2014). The student has always been integral to the feedback process, both as a recipient and as an active agent. This dual role is reflected in empirical studies and meta-analyses

(e.g., Ajjawi and Boud, 2017; Heitink et al., 2016; Lam, 2017; Winstone et al., 2017). Importantly, even the most meticulously crafted feedback has no meaningful impact if the student is unwilling or unable to engage with it. To deepen our understanding of the conditions that foster effective feedback, this study examines higher education students' reasons for not utilizing teacher and peer feedback and explores the individual variables that underpin these decisions. Understanding the reasons why students do not effectively engage with feedback is essential for developing tailored strategies that enhance the effectiveness of instructional feedback provision. This study contributes to the field by identifying key barriers to feedback utilization and offering insights that can inform more responsive and student-centered feedback practices.

Student-feedback interaction

Feedback operates as a dynamic system, with its effectiveness determined by how its elements interact as the feedback moves from source to student processing. Several models have been developed to explain the feedback formation, delivery, and implementation of feedback within educational settings (e.g., Lipnevich and Panadero, 2021; Panadero and Lipnevich, 2022). This study is framed using the Student-Feedback Interaction Model (Lipnevich and Smith, 2022), which details the way students engage with feedback and identifies key factors influencing its uptake and application. Specifically, this model considers that feedback is not merely a transmission of information but unfolds within a dynamic interaction of context, feedback sources, message, learner characteristics, and outcomes (see [Supplementary Figure S1](#)).

Feedback context

The context in which feedback occurs shapes its impact, as variations in course structure, domain norms, and cultural factors play significant roles (Yang and Carless, 2013; Parkes, 2018). In higher education settings, feedback practices are often constrained by contextual factors such as time limitations and the educators' workload, which can impact the quality and timeliness of feedback provided (Henderson et al., 2019). As noted by Winstone et al. (2017), feedback is often delivered in ways that limit its applicability, such as being provided too late for use in future assessments, involving minimal follow-up, relying on standardized forms perceived as impersonal, or subordinated to other course processes. Moreover, Winstone and Boud (2020) highlighted that feedback is often entangled with assessment, leading to an emphasis on grades rather than learning. Similarly, Morris et al. (2021) showed that while schools prioritize academic progress through exam results, universities balance academic achievement with factors like student satisfaction and perceived value for money. While this emphasis on satisfaction may improve perceptions of feedback, it can sometimes detract from the development of practical feedback strategies and actionable insights for improvement (Price et al., 2011). Additionally, students encounter barriers to utilizing feedback effectively, primarily due to a lack of strategies or understanding of academic discourse (Jonsson, 2013). These conditions contribute to students' rejection of feedback, as students may view it as irrelevant, disconnected,

or lacking effort. These findings underscore how contextual factors influence the feedback system at every level (Lipnevich and Smith, 2018, 2022).

Feedback source

Feedback can originate from diverse sources, including technology-based systems, teachers, peers, or self-assessment (Cutumisu et al., 2017; Lipnevich and Lopera-Oquendo, 2022; Nicol, 2020). Among these, the perceived credibility of the source significantly affects how students engage with feedback. Teacher feedback, for instance, is often more valued when the teacher is seen as knowledgeable and invested in the student's progress (Amerstorfer and Freiin von Münster-Kistner, 2021; Vareberg et al., 2023). A strong teacher-student relationship further enhances feedback's perceived fairness and utility (Pat-El et al., 2012).

Peer feedback, on the other hand, aligns with Vygotsky (1962) sociocultural theory, emphasizing learning through social interaction. Research highlights its benefits, such as improving academic performance (Double et al., 2020) but also emphasizes its challenges. Students often question the trustworthiness and accuracy of peer assessment and feedback (Dijks et al., 2018; Rotsaert et al., 2017). At the same time, anonymity in peer feedback can mitigate some of these concerns, although it may reduce opportunities for social learning and affect regulation (Panadero and Alqassab, 2019). Despite its complexities, peer feedback remains a valuable complement to teacher feedback, providing diverse perspectives and fostering a collaborative learning environment. Ensuring its effectiveness requires addressing students' concerns about evaluative capabilities and interpersonal dynamics. In sum, understanding the conditions under which feedback from teachers and peers is embraced (or not) can help educators design strategies that minimize rejection and maximize meaningful engagement, ultimately enhancing the feedback process.

Feedback message

Research has consistently emphasized that feedback's effectiveness depends on a combination of factors that shape how it is received and utilized. Moreover, there is a growing recognition that not all feedback is equally effective, so its impact also depends on how it is structured and delivered. In that sense, feedback features such as content, timing, tone, and orientation interact with the unique characteristics of each student. This interplay not only influences how feedback is perceived but also shapes students' learning outcomes.

Tailoring feedback to the individual student is a critical first step, as personalizing feedback to their specific work fosters greater engagement and allows them to see the relevance of the comments (Ferguson, 2011; Li and De Luca, 2012). However, personalization alone is not sufficient. Feedback must also be comprehensive and precise, providing students with clear insights into their performance and highlighting areas for improvement (Ferguson, 2011; Dawson et al., 2019). At the same time, clarity is key, as feedback that is overly vague or general can leave students uncertain about what changes to make (Máñez et al., 2024).

Equally important is the timing of the feedback. Delivering feedback soon after a task is completed ensures that students can apply it while the material is still fresh in their minds. Research has shown that timely feedback increases its likelihood of being acted upon, contributing to improved learning outcomes (Gibbs and Simpson, 2004; Poulos and Mahony, 2008). However, the question of whether feedback should be immediate or delayed is more complex than it may seem. While immediate feedback is often thought to lead to faster improvements, recent studies have demonstrated that the timing of feedback may not make as significant a difference as previously believed. A study conducted across 38 college classes found no overall learning benefit to immediate feedback, suggesting that other factors, such as the nature of the feedback and its alignment with learning objectives, are more crucial (Fyfe et al., 2021).

Furthermore, feedback must be based on clear, specific criteria to be truly effective. Students are more likely to use feedback to improve their work when they understand how it relates to predefined expectations and performance standards (O'Donovan et al., 2001; Poulos and Mahony, 2008). In this regard, feedback should not only assess past performance but also direct attention to how improvements can be made, encouraging students to think about future learning and growth (Dawson et al., 2019; Lizzio and Wilson, 2008). This future-oriented focus can help foster a growth mindset, where students view feedback as a tool for ongoing development rather than as a judgment of their abilities (Máñez et al., 2024).

The tone in which feedback is delivered also plays a significant role in how it is received. Research indicates that feedback with a supportive, constructive tone is more likely to engage students and promote positive learning behaviors, while overly authoritative or dismissive tones can hinder students' receptivity (Jonsson, 2013; Lipnevich et al., 2016; Winstone et al., 2016). Positive feedback is particularly effective in encouraging engagement, though it is important to strike a balance. Excessive praise, while initially motivating, may lead to complacency, as students may feel that they do not need to improve further (Jonsson, 2013; Lipnevich and Smith, 2022; Lipnevich et al., 2023). On the other hand, more critical comments, though initially difficult to accept, have been shown to drive meaningful improvement (Drew, 2001; Higgins et al., 2001).

The distinction between task-level and process-level feedback also merits attention (Hattie and Timperley, 2007). Task-level feedback addresses the specific content or details of the student's work, while process-level feedback focuses on the strategies and methods used to complete the task. Both types of feedback are important, but they serve different purposes. Feedback that focuses on the task itself is particularly valuable for clarifying performance expectations and helping students refine their work (Jonsson, 2013; Walker, 2009). In contrast, process-level feedback encourages reflection on the learning process, helping students develop the skills and strategies needed for future tasks (Winstone et al., 2016).

Despite the importance of detailed feedback, the sheer volume of comments can be counterproductive. Overly lengthy feedback risks overwhelming students, making it harder for them to identify the most critical aspects of their performance (Vardi, 2009). Moreover, while detailed feedback often leads to more revisions, it does not automatically guarantee that the revisions will improve the quality of the work (Ferris, 1997; Treglia, 2009).

It seems, then, that quality feedback may be more important than quantity.

In summary, effective feedback is a dynamic and multifaceted process that requires careful attention to its content, timing, tone, and alignment with students' expectations. When feedback is personalized, clear, constructive, delivered at an appropriate time, and with an accessible tone, it can significantly enhance learning. However, this is not a one-size-fits-all approach. The interaction of these factors with the student's unique characteristics ultimately shapes their perception of feedback and its impact on their learning.

Student characteristics

Each student brings unique characteristics to the feedback process, influenced by their culture, subculture, community, family, peer group, and personal traits. Understanding how these factors intersect with feedback is crucial to recognizing how students respond emotionally and cognitively to feedback. Traits such as emotional stability, feedback receptivity, and self-regulation play a significant role in determining how feedback is processed and acted upon (Clark, 2012; Goetz et al., 2018). Over the past 15 years, research has identified various learner traits that mediate the feedback process, some directly related to feedback and others more tangential. These include achievement levels (Shute, 2008), optimism (Fong et al., 2018), subject-specific abilities, prior success, and receptivity to feedback (Lipnevich et al., 2016). Other factors such as intelligence, learning strategies, self-efficacy, and motivation also impact how feedback is approached (Lipnevich and Lopera-Oquendo, 2022; Schneider and Preckel, 2017; VandeWalle and Cummings, 1997).

However, the literature concerning how students' individual characteristics, such as their gender, ethnicity and academic level may influence their academic feedback experiences is limited. For instance, Sortkær and Reimer (2022) explored the potential impact of gender and found that boys received the highest amount of feedback from teachers, whereas girls received the most feedback from their peers. In relation to gender influences on the rejection of feedback, Lundgren and Rudawsky (1998) examined whether male and female college students differed in their responses to negative feedback from parents and peers, considering factors such as relationship closeness, feedback characteristics, and emotional reactions. While no direct gender effect was found on students' refusal to use feedback, women exhibited greater tendency to not act upon feedback due to indirect factors. For example, women were provided with feedback on more important topics (which typically reduced rejection) but also experienced more negative feedback and stronger emotional responses, both of which contributed to higher rejection rates. Moreover, for Black students, particularly men, trust in teachers was shown to be crucial. A lack of trust led to academic disidentification, where students disconnected their academic self-concept from their GPA, potentially leading to dismissing feedback (McClain and Cokley, 2017). Additionally, the results suggested that feedback practices were shaped by classroom composition, including the gender distribution and the overall socioeconomic background of students.

Students value feedback for a variety of reasons, which can shape their approach to it. Rowe (2011) identified seven key

themes from a survey of over 900 undergraduate and graduate students: feedback as a guide to good grades, as a learning tool, as a form of academic interaction, as encouragement, as a means to regulate anxiety, as a sign of respect, and as a signal that the instructor cares about their work. These motivations highlight the multifaceted role that feedback plays in students' academic and emotional lives.

It is also crucial to consider how feedback interacts with students' expectations. When feedback aligns with students' prior expectations, whether based on previous feedback, rubrics, or their own goals, it is more likely to be well-received. However, mismatches between expected and received feedback can lead to confusion or frustration, diminishing the effectiveness of the feedback provided (Lipnevich et al., 2016). Similarly, the presence of grades as a form of feedback can complicate the process. Students often focus more on grades than the accompanying comments, which can detract from the value of the feedback itself. Studies have shown that anticipating grades can diminish motivation, especially when students expect positive reinforcement from feedback but instead receive an evaluative response (Lipnevich and Smith, 2009a,b).

Feedback processing

The key element of the Student Feedback Interaction Model (Lipnevich and Smith, 2022) involves how students perceive, interpret, and respond to the feedback they receive. This process is influenced by the context, source, and characteristics of both the feedback and the student (Lipnevich and Smith, 2022; Lui and Andrade, 2022; Nicol, 2020). The cognitive aspect of feedback processing involves students comprehending the feedback, reflecting on its applicability to their current and future work, and considering how it can be generalized to new contexts. The value and utility of feedback play a central role in shaping both students' emotional responses and their subsequent actions (Pekrun, 2006). Comparisons made between teacher comments, rubrics, and other feedback sources enable students to engage in self-assessment and internalize feedback, guiding future revisions and efforts (Nicol and McCallum, 2022).

Affective processing refers to the emotional reactions students have to feedback, which can impact both their motivation and their subsequent behavior. According to Cognitive-Behavioral Theory (CBT), feedback can evoke strong emotional responses, which in turn affect achievement-related behaviors (Pekrun, 2006). A positive emotional response to feedback, especially when the student understands and feels supported by it, increases the likelihood of engagement with the task. Negative emotional responses, however, can hinder this process and lead to disengagement or avoidance (Ajjawi and Boud, 2017; Brookhart, 2011; Carless and Boud, 2018; Evans, 2013).

Finally, behavioral processing involves students' specific actions in response to feedback. These actions may include rereading the feedback, making revisions, seeking additional help, or even choosing to disregard the feedback altogether. The effectiveness of these responses is influenced by factors such as the clarity of the feedback, its alignment with expectations, and the overall

emotional tone (Lipnevich and Smith, 2009a; Price et al., 2017; Graham et al., 2015).

The Student-Feedback Interaction model emphasizes the interplay among the context, source, message, student, and their processing of feedback. Together, these elements shape how feedback is understood, accepted, and applied to improve learning outcomes. While this model offers a robust framework for designing and delivering effective feedback, it also highlights potential barriers to its acceptance. In the next section, we address the critical issue of reason for not using feedback, examining the factors that lead students to resist or dismiss feedback and its implications for learning.

Reasons for feedback rejection

In this study, *feedback rejection* refers to the deliberate or unintentional disregard, dismissal, or failure to engage with feedback provided by teachers or peers. This can manifest through explicit refusal, passive inaction, or misinterpretation that prevents meaningful incorporation of the feedback into subsequent learning or performance.

Among the most significant reasons is the negative emotional responses feedback can evoke (Lipnevich and Smith, 2009b). When students feel discouraged, upset, or overly criticized, they are more likely to ignore or reject the feedback provided. This challenge is particularly pronounced for international students, who often perceive feedback as harsher compared to their domestic peers (Zacharias, 2007). Similarly, students receiving grades lower than expected may experience feelings of sadness, shame, or anger, which further diminishes their willingness to engage with feedback. Negative emotional reactions, therefore, play a critical role in feedback rejection, as they inhibit constructive engagement and learning (Ryan and Henderson, 2018).

Cognitive barriers also hinder a students' ability to act on feedback. Many students struggle to understand the academic language and complex terminology often used in feedback, leading to frustration and disengagement. Feedback perceived as too effortful to decode or implement can deter students from seeing its value or applying it meaningfully (Winstone et al., 2017). Additionally, when feedback lacks relevance or specificity, such as general comments or guidance that does not align with their priorities, students may view it as unhelpful and dismiss it (Jonsson, 2013).

Psychological processes, including students' sense of agency and willingness to exert effort, further influence feedback acceptance. Students who feel powerless or unsupported in their learning may reject feedback as they see little connection between their actions and improvement. Social and contextual dynamics, such as the quality of the relationship with the feedback giver or the perceived fairness of the process, can also amplify resistance (Coombes, 2021). For instance, overly critical feedback from peers or parents or time constraints that limit meaningful discussion of feedback can exacerbate rejection.

While these factors provide valuable insights, research on the reasons to reject feedback remains limited and often lacks methodological rigor. Many studies rely on small sample sizes or do not fully capture the complexity of the feedback process (Van

der Kleij and Lipnevich, 2021). To address these gaps, the present study was conducted.

Current study

Feedback is a critical component of the learning process, as it provides students with the necessary information to improve and develop their skills. However, for feedback to be beneficial, it must be effectively received and utilized by students. While a substantial body of research has identified what learners need to accept feedback, there is a gap in understanding the specific reasons behind students reasons for rejecting the feedback. Much of the existing literature on feedback assumes that the reasons for rejection are merely the inverse of those for accepting feedback. However, this approach may oversimplify the issue, especially given that rejecting academic feedback can often be emotionally driven. As Hernandez et al. (2018) noted, “well-being is not simply the flipside of negative affect or ill-being” (p. 20), suggesting that emotional responses to feedback should not be treated as opposites of positive acceptance.

To address this gap, the aim of our mixed methods study was 2-fold. First, through open-ended questions, we sought to gain a deeper understanding of why higher education students reject feedback provided by both teachers and peers about their academic assignments. Second, we explored how individual characteristics, such as gender and academic major, might influence students’ reasons for rejecting feedback. By investigating these factors, we aimed to provide more nuanced insights into the complex dynamics of feedback rejection issues. To guide this study, we proposed three research questions:

- 1) What reasons do college students have for rejecting the feedback provided by their instructors?
- 2) What reasons do college students have for rejecting the feedback provided by their peers?
- 3) To what extent do college students’ gender, ethnicity, and academic level predict the reason to reject teacher and peer feedback?

Method

Participants

A total of 200 undergraduate and graduate students from various colleges within a large public university in the northeast of the USA participated in the study. Demographic information for 198 participants (99%) was obtained from academic records (Table 1). The sample consisted of 67.7% women ($N = 143$), 53% ($N = 105$) enrolled in undergraduate programs, and 35.4% identified as White. Among undergraduates, the most common majors were Psychology (28.0%), and Education (11 %). For graduate students, the most frequently pursued programs were the Advanced Certificate in Education (24.5%) and the Master of Arts in Teaching Childhood Education (18.5%).

TABLE 1 Demographic characteristics of the participants.

Variable	N	%
Gender		
Female	134	67.7
Male	64	32.3
NA	2	0.8
Ethnicity		
Asian	52	26.3
Black	26	13.1
Hispanic/Latino	48	24.2
White	70	35.4
NA	2	0.8
Academic level		
Undergraduate	105	53.3
Graduate	93	20.9
NA	2	0.8
Program (undergraduate)		
Psychology	56	28.0
Education (Early Childhood, Elementary, Physical Ed.)	22	11.0
Sciences (Bio. Sci., Chem., Human Bio.)	9	4.5
Other (Chinese, Comp. Sci., Eng. Lit., Ling., Nursing, Soc.)	9	4.5
Program (masters)		
Adv. Certificate (Art Ed., Child Ed., Music Ed., Phys. Ed.)	49	24.5
Master of Arts in Teaching (Adol. Ed., Childhood Ed.)	37	18.5
Other (Library Sciences, TESOL)	6	3.0
Non-Degree/Undeclared	12	1.5
Total	200	100

Procedure

In this study, as part of an academic activity during class, participants were inquired with the following open-ended questions:

- 1) *Please think of academic situations in which you rejected the instructor’s feedback. Why did you choose not to incorporate the instructor’s comments? Describe three possible reasons why you did not use feedback.*
- 2) *How about peer feedback? Please describe specific situations in which you rejected a peer’s feedback on an academic assignment.*

This task was part of the course requirements and was expected to be taken seriously by the students. While all students completed the task, only those who provided informed consent were included in the study. All participants received extra credit for their involvement in the activity. The Institutional Review Board approved the study (protocol number 2023-0661-QC).

TABLE 2 Description of themes and codes used during coding.

Theme	Code	Description
Context	No opportunity to revise	There were no opportunities to incorporate the feedback.
	Timing	The feedback was provided too fast or too late.
Message	Ambiguous/unclear feedback	I didn't know what the teacher meant.
	Excessive information	The feedback contained too much information to process. The feedback was overly detailed.
	Inaccurate feedback	The feedback is incorrect. The feedback made no sense. The student felt their work didn't need adjusting.
	Negative feedback tone	The feedback read as condescending or rude.
	Praise	The feedback read as excessively positive.
Recipient	Incongruent with expectations	Misalignment between the expected feedback and the provided feedback.
	Motivation	The student was unmotivated. The student felt too lazy.
	Personality traits	The student stated their trait as the reason.
	Satisfied with grade	The student didn't use the feedback because they felt their task/grade didn't need to be improved. The student felt their work was "good" and done "well".
	Lack of value/utility	The feedback didn't have value for the student; was not useful.
	Negative affect	The student felt negative emotions due to the feedback.
Source	Lack of respect for teacher	The student didn't like/respect the teacher's opinions or perspective.
	Lack of trust in teacher	The student didn't trust in the teacher's knowledge or skills.

Qualitative data coding

The participants' open-ended responses about the two dimensions of analysis (teacher feedback and peer feedback rejection reasons) were analyzed using a deductive approach with a coding system based on the feedback model provided by Lipnevich and Smith (2022). This model served as the theoretical framework for defining the dimensions of analysis and their respective codes. Tables 2, 3 present the definitions of codes by dimension. Supplementary Tables S1, S2 also display examples of sentences for each code.

A total of four themes were defined to code the responses about the reason rejected teachers: context, message, source characteristics, and recipient's characteristics, while responses about peer feedback rejection were coded within the themes message, source, and recipient's characteristics. Fifteen codes were used to classify participants' responses regarding rejecting teachers' feedback, while eight codes were used to classify responses related to the reason for rejecting peer feedback. Open-ended response

TABLE 3 Description of themes and codes used to code responses about reasons for rejecting peer feedback (question 2).

Theme	Code	Description
Message	Ambiguous/unclear feedback	The feedback didn't clearly state what the peer was suggesting for the student.
	Negative feedback tone	The feedback read as condescending or rude.
Recipient	Confidence with performance	The student felt their work was "good" and done "well." The student felt their work didn't need adjusting.
	Lack of value/utility	The feedback didn't have value for the student; was not useful.
	Negative affect	The student felt negative emotions due to the feedback.
Source	Lack of peer expertise	The student didn't trust in the peer's knowledge or skills.
	Lack of trust in peer	The student didn't believe the peer was acting on good intentions.

coding was conducted separately for teacher- and peer feedback-related reasons based on the task. The unit of analysis for coding was defined as a sentence rather than a complete participant response to ensure consistency across coders.¹

A total of 185 and 123 participants provided responses regarding reasons for rejecting teacher and peer feedback rejection reasons, respectively. Two researchers from the team classified 706 sentences related to teacher feedback and 265 sentences related to peer feedback using ATLAS.ti (version 23.2.1) software. Interrater reliability was calculated using Krippendorff's α coefficient, a nonparametric measure of agreement (Hughes, 2021) provided by ATLAS.ti Scientific Software Development GmbH (2023). The coding process was divided into four rounds. First, the coders classified 10 common responses to calibrate and review the coding system (Krippendorff's $\alpha = 0.712$). A meeting was held with all authors to discuss discrepancies and agree on final codes. Second, an additional set of 10 responses were jointly classified, showing and acceptable agreement (Krippendorff's $\alpha = 0.849$). A third round, with 15 common responses, was additionally conducted, obtaining an acceptable agreement (Krippendorff's $\alpha = 0.899$). Finally, the remaining responses were evenly distributed between the two coders, with 20 random responses coded jointly, leading to an acceptable agreement (Krippendorff's $\alpha = 0.800$). Discrepancies were solved through discussions with coders.

Data analysis

First, we examined descriptive information about participants' responses regarding reasons for rejecting teacher and peer feedback and presented a qualitative analysis focusing on the rationality and examples behind each coding category derived from our thematic

¹ Sentence was defined as a complete phrase, which ranges from several words to an entire paragraph, which begin with a capital letter and end with a period [.] as terminal punctuation.

analysis approach. Second, to answer the first and second research questions, frequencies for each code for the total sample and by participant's gender and academic level were calculated. Z-tests to compare observed proportions were then estimated. Finally, we conducted multiple logistic regression to examine the third research question. Models using a binomial distribution were fitted to estimate the main effect of gender, ethnicity, academic level, and GPA on the probability of providing reasons for rejecting teacher or peer feedback due to aspects related to each dimension of analysis. The proportion of codes in each dimension was used as a dependent variable (which is an event/trial form variable rather than a binary observation), whereas student's gender, ethnicity, academic level, and GPA were used as predictors. Further, Zero-Inflated Poisson (ZIP) and Zero-Inflated Negative Binomial (ZINB) distributions were estimated to deal with the overabundance of zero counts in some subcategories. Model goodness of fit statistics was calculated for selecting the best model fit by subcategory. Better models correspond to smaller Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) (Friendly and Meyer, 2015). Plot analyses were also generated to check model assumptions. All the analyses were conducted using R software version 4.1.2 (R Core Team, 2021).

Results

Descriptive statistics

A total of 200 participants took part in the study, with 192 providing valid responses. Specifically, 185 participants responded to questions about rejecting teacher feedback, while 123 provided responses regarding peer feedback rejection reasons. In total, 706 sentences related to teacher feedback and 265 sentences related to peer feedback were identified and coded.

On average, participants gave 3.8 sentences when explaining reasons for rejecting teacher feedback ($M = 3.8$, $SD = 2.5$, range = 1–16) and 2.15 sentences ($M = 2.15$, $SD = 1.26$, range = 1–7) when addressing reasons for rejecting peer feedback. This resulted in a total of 806 codes being identified in the teacher feedback responses ($M = 4.6$, $SD = 2.8$, range = 1–16) and 287 codes ($M = 2.33$, $SD = 1.35$, range = 1–8) for the peer feedback responses.

Qualitative results

This study aimed to identify common themes in students' reasons for rejecting feedback from their peers and instructors (Tables 2, 3). By coding student responses, we identified overarching themes that align with the Student-Feedback Interaction framework (Lipnevich et al., 2023).

Students' reasons for rejecting instructor feedback in an academic setting

A major finding immediately stands out: of the 706 phrases coded regarding the reasons to reject teacher feedback, the "Message" accounted for the largest proportion of coded phrases

(352), followed closely by "Recipient" (341), "Source" (112), and "Context" (43). Therefore, the dominance of the "Message" and "Recipient" categories, which together accounted for the majority of coded phrases, highlights that both the feedback content and the student's characteristics are imperative factors in feedback acceptance. It is noteworthy that participants responded based on their own experiences, without being unaware of any categories or seeking to assign responsibility to themselves or their instructor.

Context

The "Context" theme generated the fewest aggregate codes, with a total of 43, incorporating only instances where students reported inappropriate *timing* or *no opportunity to revise*. For the *timing* category, we focused on statements where the students complained about receiving feedback too early, at times not allowing the student to complete their assignment—"...a teacher gave me feedback before I even started my presentation." or too late, for instance "Another reason why I didn't use the feedback was that I had done the assignment a month prior, and feedback was given a month later." Moreover, statements coded in this theme also included instances in which the respondents focused on the issue of *no opportunity to revise*, as seen in: "wouldn't have even been able to apply the feedback" because it was the "final paper for our class."

Source

This theme encompasses codes describing both the *lack of respect for teacher* and the *lack of trust in teacher* as it focuses on the students' perceptions regarding their instructor. The first code captures instances where students expressed dislike for the teachers themselves and their opinions or perspectives. The second focuses on a lack of trust in the teacher's knowledge or skills. The difference between those categories is evident when looking at examples of participants' statements. Fitting within the first code, one respondent stated, "...if I don't like them as a teacher then I also may not want to take their feedback." This illustrates how students' negative perceptions of the teachers could lead to the rejection of instructional feedback. In contrast, for the latter code, responses included statements such as: "I chose not to implement their feedback since this teacher couldn't demonstrate their own concepts..." This example highlights a lack of trust in the instructors' competence and expertise. A total of 112 statements were coded within this theme, demonstrating that the student perception of the instructor is a critical factor in their decision to engage with instructional feedback.

Message

We identified five different codes that fit within the "Message" theme, and they accounted for a total of 352 of the coded sentences. Within this theme, the most prominent reason for rejecting feedback, cited by 161 respondents, was its lack of accuracy. Responses that addressed the correctness of the feedback or expressed students' disagreement with it were coded under *Inaccurate Feedback*. That is, statements coded as *inaccurate feedback* reflected instances where students identified discrepancies between their work and the feedback provided. For

example, one respondent explained that they had misnumbered their responses, but after comparing answers with another student, they realized their work was correct, just in a different order. The respondent noted, “Another student had the same answer, and he said she was correct.”

The code, *ambiguous/unclear* feedback also emerged as a prominent reason for rejecting feedback, encompassing 115 responses, making this the second-most cited issue. Students’ responses consistently highlighted how feedback lacked comprehensibility, with comments such as: “not clear enough,” “wasn’t very detailed,” or “did not understand what they meant.” The respondents explained how this lack of comprehensibility led to them not engaging with the feedback.

Negative feedback tone emerged as a significant issue for rejecting instructor feedback. Respondents described experiences where instructors focused solely on the negative aspects of their work - “I had an instructor cross out an entire paragraph and only wrote negative things about it”; be worded negatively - “...completely negative especially the way it was worded...”; or use language that would be identified as negative - “What I had received were insults...” Unlike in the *negative affect* category, the statements coded as *negative feedback tone* did not necessarily evoke negative emotional responses in students (participants did not indicate how those situations affected them emotionally). Instead, they were deemed dismissive, rejective, or too pessimistic.

The amount of feedback received also emerged as a significant reason for participants to reject feedback and was coded as *excessive information*. Excessive feedback can make students feel overwhelmed and unsure of which aspect to address first. It can be difficult for them to focus on what matters, or they might not read the feedback because it appears lengthy. We identified 11 responses of *excessive information*, including instances such as “...too much information...” and “too many repetitive comments.”

The final code that fits into the “Message” theme was *praise*. *Praise* was a less frequently cited reason for rejecting feedback, appearing only in four responses, but still noteworthy. Participants reported rejecting feedback that contained “...positive praise...” “...receiving compliments...” or when they were said to be “...doing amazing...” but these assessments felt overly positive and made students doubt the authenticity of all feedback.

Recipient

Respondents frequently acknowledged personal factors as reasons for rejecting feedback, often taking responsibility for their decisions. A total of 341 sentences were coded in six categories within this theme, highlighting various individual characteristics that influenced their predisposition to reject feedback.

The most common reasons cited was *satisfaction with grades*, with 111 responses reflecting this idea. Students reported believing that their performance had met expectations or felt their work was “spot on,” and there was no need to engage with the feedback further. Participants statements include “I didn’t feel the need to redo my work just to get it one point higher.” and “I was confident in my work and didn’t feel that the suggestion was necessary.”

Emotional reactions also played a key role, with 68 responses reporting how *negative affect* influenced their rejection of feedback. Students described experiencing emotions such as fear, frustration, embarrassment, confusion, and sadness. These feelings often arose

from feedback that made them feel judged or criticized. One respondent articulated the broader implications of this dynamic, stating, “This type of feedback gives a negative relationship between the teacher and the students.”

Another reason for rejecting feedback was its perceived *lack of value or utility*, with 54 responses indicating this issue. After processing the feedback, some students decided it was neither helpful nor necessary. For example, one student noted, “the feedback I received was useless – it doesn’t help me any way.”

Individual personality traits were also cited as a reason for rejecting feedback in 50 responses. Participants described themselves using adjectives such as prideful, stubborn, shy, nervous, embarrassed, skeptic, and timid, attributing their aversion to feedback to inherent characteristics or traits shaped by their upbringing. Additionally, some students noted how their mental and emotional wellbeing at the time of receiving feedback impacted their ability to engage with it, as reflected in comments like, “I was struggling mentally and emotionally at the time.”

Lack of *motivation* was identified as another factor in 47 responses, with students describing how their low energy or interest influenced their decisions. For instance, one respondent admitted, “...too lazy... I did not want to give any additional effort to the assignment.” This lack of motivation was often tied to specific periods, such as the end of a semester or program “...it was my senior year of high school...” Relatedly, some students reported rejecting feedback due to a lack of interest in the course or grade, exemplified by the statement, “It was a required course that I had to take and forget about; I didn’t care about it.”

Lastly 19 responses discussed feedback rejection due to its *incongruence with students’ expectations*. Respondents noted situations where they believed they had adhered to guidelines but received lower grades than anticipated. One student expressed their frustration, saying, “Even though you follow the guidelines, they still give you a lower grade than what you expected.”

Students’ reasons for rejecting peer feedback in an academic setting

Participants were asked about their reasons for rejecting peer feedback (RQ2), and their answers were coded following the same elements described in the Lipnevich and Smith (2022) model. When responding to their reasons for rejecting feedback from their peers, only three themes were identified: Source, Message, and Recipient. Neither inductive nor deductive coding led us to create codes for Context. It may be that because peers do not have control over the learning environment, there was no reason to assign responsibility in terms of context.

Participants indicated the source as the main reason for their decision to reject peer feedback, with 131 coded responses. Two primary reasons were identified: *lack of trust in peer*, with 70 coded responses and *lack of peer expertise*, including 61 statements. Students reported not believing that their peers were acting with good intentions, which was partially due to the fact that because peer feedback was required by the instructor and not offered freely by the peer – “...they gave feedback just because they had to/were forced to give feedback...” and the requirement led to comments that were

overly critical comments– “...peers are just looking to find something to critique in order to complete the assignment.” The second code was assigned when they believed the peer did not have adequate knowledge or experience to provide feedback. Students see their peers as lacking expertise because they are “younger” or “less intelligent.” For instance, one participant wrote: “I tend not to take it because peers don’t have teacher-level expertise.”

Recipient

The recipient also appeared as a major reason for peer feedback rejection, with 120 linked to this theme. Within this theme, the majority of codes referred to the lack of value/utility (59) and confidence with performance (49). For the first code, respondents stated their rejection due to feeling they “got nothing out of it,” whereas for the second code, participants affirmed that “if I’m confident in my work and I don’t feel as though this person’s contributions would help my work then I wouldn’t want to use it.”

The last code within the Recipient Processing theme was negative affect, with 12 instances. Respondents explained that they feel anxious or attacked when receiving peer feedback. Their negative emotions would arise in response to the feedback, prompting their choice to reject it. The following coded paragraph provides a clear insight into this situation:

“This is not for any reason regarding a lack of trust or credentials, but more so from equating my peers to myself, and feeling that I should either already know how to do what I’m being given feedback on, or that my work is so poor, that even those in similar positions to myself have critiques.”

Message

The content of peer feedback was also indicated as a possible reason for rejection, with 36 responses coded in this theme and 2 identified codes: ambiguous/unclear and negative feedback tone. For the first code, which appeared in 21 responses, students’ statements repeatedly mentioned peer feedback as being unclear, vague, not specific, very broad, not making sense, incoherent, and lacking explanation. In one response, the student stated several months had passed since receiving the feedback and, “I still don’t know what he meant...” The second code, which included 15 instances, included messages that were perceived as having a negative tone, that were disrespectful, biased, polarized, or judgemental. One participant stated that the message was “...in a tone of disrespect and passive aggressiveness...”

Quantitative results

Reasons college students have for rejecting teacher and peer feedback

We first calculated the overall descriptive statistics for each reason (code) to reject teacher and peer feedback to draw a general picture of the comments provided and widely explained in previous sections. Regarding teacher feedback (Table 4), the most frequent reason to reject teacher feedback was related to the characteristics of the message ($N = 352$, 49.9% of all codes). Among these, inaccurate

TABLE 4 Distribution of reasons (codes) to reject teacher feedback by theme.

Theme	Code	N	%
Context	No opportunity to revise	13	1.8
	Timing	30	4.2
Message	Ambiguous/unclear feedback	115	16.3
	Excessive information	11	1.6
	Inaccurate FEEDBACK	161	22.8
	Negative feedback tone	61	8.6
	Praise	4	0.6
Recipient	Incongruent with expectations	19	2.7
	Motivation	47	6.7
	Lack of value/utility	54	7.6
	Negative affect	68	9.6
	Personality traits	50	7.1
	Satisfied with grade	111	15.7
Source	Lack of respect for teacher	83	11.8
	Lack of trust in teacher	29	4.1

Seven hundred and six sentences were analyzed. Note that the codes are not mutually exclusive, so the aggregate values do not necessarily correspond to the total number of sentences.

feedback ($N = 161$) and ambiguous or unclear feedback ($N = 115$) were the most commonly reported issues, representing 22.8 and 16.3% of the total codes, respectively, followed by negative feedback tone, which accounts for 8.6% ($N = 61$). Other concerns, such as message incongruent with expectation (2.7%), excessive information (1.6%) and praise (0.6%), were less prevalent. For the recipient theme (49.4% of the total), satisfaction with grades ($N = 111$, 15.7%), and negative affect ($N = 68$, 9.6%) were the most frequent issues, suggesting that students’ responses to feedback often center around their perceived performance and its effect on their overall satisfaction and mood.

The source theme, which includes how recipients perceive the person providing the feedback, accounts for 15.9% ($N = 112$) of the overall codes. The most prominent issue within this category is the lack of respect for the teacher, which represents 11.8% ($N = 83$) of the total responses. Finally, context themes only account for 6% of the overall codes.

Table 5 presents the distribution of reasons to reject peer feedback by theme (message, recipient processing, and source). The most frequent theme identified to reject peer feedback was related to the characteristics of the source, which accounted for 49.4% ($N = 131$) of the total responses. Within this theme, lack of trust in peers emerged as the predominant code, representing 26.4% of all responses ($N = 70$). Similarly, lack of peer expertise accounted for 23% of the responses ($N = 61$), indicating that students often viewed their peers as insufficiently knowledgeable or qualified to provide valuable feedback. The second most prominent theme was recipient processing aspects, representing 45.3% of the total codes ($N = 120$). The most frequently cited reason to reject peer feedback within this theme was lack of value/utility of message (22.3%, $N = 59$), followed by confidence with performance (18.5%, $N = 18.5$), which indicates that students who were confident in their own

TABLE 5 Distribution of reasons (codes) to reject peer feedback by theme.

Theme	Code	N	%
Message	Ambiguous/unclear feedback	21	7.9
	Negative feedback tone	15	5.7
Recipient	Lack of value/utility	59	22.3
	Confidence with performance	49	18.5
	Negative affect	12	4.5
Source	Lack of trust in peer	70	26.4
	Lack of peer expertise	61	23

Two hundred and sixty-five sentences were analyzed. Note that the codes are not mutually exclusive, so the aggregate values do not necessarily correspond to the total number of sentences.

work were less likely to regard peer feedback as beneficial. Finally, characteristics of the message accounted for 13.6% of the responses ($N = 36$), with ambiguous or unclear feedback identified in 7.9% ($N = 21$) of sentences and negative feedback tone in 5.7% ($N = 15$). Further explanation on the coding process and examples of students' responses for each code are presented in our qualitative findings.

Characteristics of responses regarding teacher and peer feedback rejection

The proportion of reasons to reject feedback as a function of respondent's gender and academic level and Z-tests to compare observed proportions were then estimated. Regarding teacher feedback (Table 6), female participants were less likely to state *negative feedback tone* ($p = 0.04$) and *lack of value/utility* ($p = 0.03$) as reasons for rejecting teacher feedback than males. Conversely, they were more likely to have *inaccurate feedback* as a reason to reject feedback than males ($p = 0.03$).

Education level also showed several significant differences. Undergraduate students more often claimed *lack of value* as a reason for rejecting teacher feedback than graduate students ($p < 0.001$). On the other hand, graduate students more often cited *negative feedback tone* ($p = 0.04$) and *negative affect* ($p = 0.03$) as reasons to reject teacher feedback.

Regarding peer feedback (Table 7), female students were less likely to claim a *lack of peer expertise* ($p = 0.02$) than their male counterparts. Conversely, male participants were less likely to say that *negative tone* was their reason for rejection ($p = 0.03$) than females. The only difference in academic level was related to *negative affect*, with undergraduates being less likely to cite this as a reason ($p = 0.01$) compared to graduate students.

Forecasting reasons to reject teacher and peer feedback: the effect of gender, race, educational level, and GPA

Multiple logistic regression models were conducted to examine the extent to which gender, race, educational level, and GPA predict the type of claims for rejecting teacher and peer feedback among students. Separate models were estimated for the total sample of participants who independently provided rejection claims for teacher and peer feedback. The dependent variable was

the proportion of codes assigned to reject feedback by participants for each theme. Supplementary Table S3 displays the goodness-of-fit test statistics for all models conducted. Comparison of goodness-of-fit statistics for models conducted with categories with zero-inflated indicates that the best model for adjusted data were logistic regression models with a binomial link function (Supplementary Tables S3, S4). Plot analyses were also generated to check linear model assumptions (Supplementary Figures S1–S6), showing an overall acceptable adjustment of normality, outliers, and heteroscedasticity criteria.

Table 8 presents descriptive information for the dependent variable for the total sample's teacher and peer feedback themes. With respect to teacher feedback, on average, 42.2% of the participants provided reasons to reject feedback related to the message characteristics, such as ambiguous/unclear feedback, excessive information, and inaccurate feedback. In comparison, 40.3% of participants provided reasons related to the recipients, such as motivation, satisfaction with grade and personality. Only 5.5% of participants claimed that a reason for rejecting feedback related to context, such as lack of opportunities to revise feedback and timing. This category was excluded from the subsequent analysis because the proportion of responses was very low (around 5%), and the overall model fit (F -test and p -value) was not statistically significant. With respect to peer feedback, on average, 43.7 and 43% of participants provided reasons to reject this kind of feedback due to aspects relating to the recipient processing (lack of value/utility, confidence in Performance, and negative affect) and the source (lack of trust and peer-expertise).

According to the results (Table 9) individual variables such as gender, ethnicity, level of education, and GPA did not predict the type of claims for rejecting teachers in our sample.

Regarding peer feedback rejection (Table 10), results indicate that male students were 2.40 ($\beta = 0.87$, $p < 0.01$) times more likely to reject peer feedback due to aspects regarding sources aspects than females. Conversely, male participants were 0.55 times less likely ($\beta = -0.59$, $p = 0.04$) to reject feedback for recipient-related aspects than female participants.

Discussion

This mixed methods study explored students' reasons for rejecting feedback from their instructors and peers. Through data obtained from open-ended questions, students' responses were coded in themes following the student-feedback interaction model (Lipnevich and Smith, 2022).

In relation to students' reasons for rejecting teacher feedback, a major finding stands out from the coded data. Among the 706 phrases coded, the "Message" theme accounted for the largest proportion of coded phrases (352), followed closely by "Recipient" (341). These results emphasize that both the content of the feedback and the characteristics of the student are crucial factors in feedback acceptance. These findings are important, as factors within the student (e.g., motivation, expectations, or personality traits) are often beyond instructors' direct control. However, the content and delivery of feedback ("Message") are entirely within the instructor's command.

TABLE 6 Distribution of teacher feedback codes by theme as a function of gender and degree level.

Theme	Code	Gender						Degree Level					
		Female		Male		TDP		Undergraduate		Graduate		TDP	
		<i>n</i>	%	<i>n</i>	%	χ^2	<i>p</i>	<i>n</i>	%	<i>n</i>	%	χ^2	<i>p</i>
Context	No opportunity to revise	11	2.3	2	1	0.70	0.40	9	2.5	4	1.2	1.00	0.32
	Timing	24	4.9%	6	2.9%	0.97	0.32	17	4.7	13	3.9	0.14	0.71
Message	Ambiguous	72	14.8	41	19.9	2.42	0.12	68	19	45	13.4	3.53	0.06
	Negative tone	32	6.6	24	11.7	4.37	0.04*	21	5.9	35	10.4	4.29	0.04*
	Inaccurate feedback	125	25.7	36	17.5	5.00	0.03*	87	24.3	74	22.1	0.35	0.55
	Excessive information	8	1.6	3	1.5	0.00	1.00	9	2.5	2	0.6	2.94	0.09
	Incongruent with expectations	15	3.1	4	1.9	0.34	0.56	7	2	12	3.6	1.16	0.28
	Praise	1	0.2	3	1.5	2.07	0.15	13	3.6	10	3	0.00	1.00
Recipient	Personality traits	41	8.4	9	4.4	2.97	0.08	28	7.8	22	6.6	0.24	0.62
	Motivation	24	5.7	12	9.2	2.24	0.13	28	7.8	19	5.7	0.95	0.33
	Satisfied with grade	76	15.6	35	17.0	0.12	0.73	58	16.2	53	15.8	0.00	0.97
	Confidence with performance	66	13.6	22	10.7	0.83	0.36	45	12.6	43	12.8	0.00	1.00
	Negative affect	54	11.1	14	6.8	2.55	0.11	26	7.3	42	12.5	4.86	0.03*
	Lack of value/utility	28	5.7	22	10.7	4.55	0.03*	42	11.7	8	2.4	21.2	0.00***
Source	Lack of respect for teacher	57	11.7	25	12.1	0.00	0.97	38	10.6	44	13.1	0.83	0.36
	Lack of trust in teacher	18	3.7	10	4.9	0.25	0.62	14	3.9	14	4.2	0.00	1.00

TDP, test difference of proportion.
p* < 0.05; *p* < 0.01, ****p* < 0.001.

TABLE 7 Distribution of peer feedback codes by theme as a function of gender and degree level.

Theme	Code	Gender						Degree Level					
		Female		Male		TDP		Undergraduate		Graduate		TDP	
		<i>n</i>	%	<i>n</i>	%	χ^2	<i>p</i>	<i>n</i>	%	<i>n</i>	%	χ^2	<i>p</i>
Source	Lack of trust in peer	41	24.1	29	30.9	0.00	1.00	52	28	18	23.1	0.44	0.50
	Lack of peer expertise	33	19.4	28	29.8	5.42	0.02*	44	23.7	17	21.8	0.03	0.87
Message	Ambiguous	14	8.2	7	7.4	2.42	0.12	15	8.1	6	7.7	0.00	1.00
	Negative tone	12	7.1	3	3.2	4.96	0.03*	11	5.9	4	5.1	0.00	1.00
Recipient processing	Lack of value/utility	44	25.9	15	16	0.03	0.86	46	24.7	13	16.7	1.62	0.20
	Confidence with performance	34	20	14	14.9	0.83	0.36	31	16.7	17	21.8	0.66	0.42
	Negative affect	7	4.1	5	5.3	0.34	0.56	4	2.2	8	10.3	6.56	0.01*

TDP, test difference of proportion.
**p* < 0.05.

Diving deeper into the theme “*Message*,” which was unsurprisingly our largest theme, students expressed frustration with feedback that was unclear, ambiguous, excessive, rude, or focused on praise. These findings align with existing research (Winstone et al., 2017; Máñez et al., 2024), which emphasizes that clarity and tone are crucial for effective feedback. Feedback perceived as ambiguous or overly critical may fail to convey actionable steps for improvement, leaving students feeling unsupported. Interestingly, several participants in our sample reported rejecting feedback that was too extensive. While previous research suggests that students prefer detailed feedback (Blair et al., 2013; Lipnevich and Smith, 2009a,b), this finding highlights the fine balance between providing enough detail and overwhelming

students. Many participants also reported rejecting feedback they perceived as inaccurate or misaligned with their work. Disagreement with the feedback by questioning its accuracy emerged as the primary reason for rejection, aligning with Fithriani (2018) findings, which highlight that L2 students often reject feedback when it conflicts with their own beliefs. This emphasizes an important point: students do not passively accept teacher feedback as inherently valid and correct. Instead, they actively evaluate the feedback, and when it does not align with their individual perceptions, they may reject it. Within the “*Recipient*” theme, satisfaction with one’s own performance emerged as a significant factor influencing feedback rejection. Many students reported rejecting feedback because they

believed their work had already met expectations. This finding supports the negative impact of grades on student motivation (Koenka et al., 2019). When students feel their performance is “good enough,” they may be less inclined to engage with feedback, which is problematic as students’ beliefs about performance sufficiency may conflict with instructors’ standards. This finding

stresses the importance of fostering a growth mindset and helping students see feedback as an opportunity for learning rather than a critique of their performance. Unexpectedly, many codes were related to participants’ personality traits. Participants frequently described characteristics such as pride, skepticism, or nervousness as influencing their rejection of feedback. While personality traits are beyond the instructor’s direct control, other aspects within the “Recipient” theme can be addressed. For instance, instructors can enhance the perceived value of feedback by explicitly connecting it to the task’s objectives or providing clear rubrics to help students adjust their expectations. Still, within the theme of recipient processing, students reported having rejected feedback when feedback evoked negative emotions. The link between feedback and emotions is well-established in the literature (Fong and Schallert, 2023; Pekrun et al., 2014). For instance, Ryan and Henderson (2018) found that the lack of congruence between students’ expectations and teacher feedback led to higher rates of experiences of negative emotions. Interestingly, reasons associated with the source of the feedback, such as lack of trust in the instructor’s competence or respect for their perspective, were less prevalent but still noteworthy. As in previous research, the strength of the student-teacher relationship and students’ beliefs in their teacher’s credibility influence how the recipients interact with feedback (Amerstorfer and Frein von Münster-Kistner, 2021; Hyland, 2013;

TABLE 8 Descriptive information for the proportion of codes in each theme.

Theme	N	Mean	SD	Skew	Kurtosis
Teacher-feedback rejection themes					
Context	185	0.055	0.151	3.214	11.783
Message	185	0.424	0.328	0.298	−1.006
Recipient characteristics	185	0.403	0.317	0.346	−0.870
Source	185	0.118	0.200	1.756	2.586
Peer-feedback rejection themes					
Message	123	0.132	0.287	2.149	3.418
Recipient processing	123	0.430	0.419	0.297	−1.564
Sources	123	0.437	0.423	0.220	−1.634

TABLE 9 Logistic regression.

Theme	Predictor	β	OR	OR 95% CI [LL, UL]	<i>p</i>
Source	Intercept	−3.67 (1.24)	0.00	[0.00–0.27]	0.03**
	Gender [male]	0.15 (0.24)	1.16	[0.72–1.84]	0.53
	Ethnicity [Asian]	0.38 (0.26)	1.46	[0.86–2.44]	0.16
	Ethnicity [Black]	−0.14 (0.43)	0.87	[0.35–1.94]	0.64
	Ethnicity [Hispanic/Latino]	0.20 (0.32)	1.23	[0.65–2.31]	0.63
	Level [undergrad]	−0.27 (0.27)	0.77	[0.46–1.29]	0.32
	GPA	0.49 (0.33)	1.63	[0.87–3.20]	0.14
Message	Intercept	−0.72 (0.76)	0.486	[0.11–2.16]	0.35
	Gender [male]	0.08 (0.16)	1.085	[0.78–1.5]	0.62
	Ethnicity [Asian]	−0.02 (0.2)	0.978	[0.67–1.43]	0.91
	Ethnicity [Black]	0.11 (0.26)	1.114	[0.67–1.85]	0.68
	Ethnicity [Hispanic/Latino]	−0.21 (0.21)	0.808	[0.53–1.23]	0.32
	Level [undergrad]	0.12 (0.18)	1.122	[0.79–1.61]	0.53
	GPA	0.08 (0.2)	1.088	[0.73–1.63]	0.68
Recipient	Intercept	1.01 (0.75)	2.747	[0.63–12.09]	0.180
	Gender [male]	−0.02 (0.17)	0.977	[0.70–1.35]	0.891
	Ethnicity [Asian]	−0.27 (0.2)	0.761	[0.51–1.12]	0.173
	Ethnicity [Black]	−0.14 (0.26)	0.870	[0.52–1.45]	0.597
	Ethnicity [Hispanic/Latinx]	0.06 (0.21)	1.064	[0.70–1.61]	0.769
	Level [undergrad]	−0.05 (0.18)	0.953	[0.67–1.36]	0.792
	GPA	−0.37 (0.2)	0.693	[0.47–1.03]	0.069

Gender, ethnicity, education level, and GPA as predictors of the proportion of codes regarding teacher feedback by theme.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Values in parenthesis indicate the standard error. Values in brackets indicate the 95% confidence interval of odds ratio estimation. LL and UL indicate the lower and upper limits of the odds ratio.

TABLE 10 Logistic regression.

Theme	Predictor	β	OR	OR 95% CI [LL, UL]	<i>p</i>
Source	Intercept	−0.38 (1.15)	0.69	[0.07–6.51]	0.74
	Gender [male]	0.87 (0.29)	2.40	[1.37–4.28]	0.00**
	Ethnicity [Asian]	0.38 (0.39)	1.46	[0.68–3.15]	0.33
	Ethnicity [Black]	−0.22 (0.42)	0.80	[0.35–1.81]	0.59
	Ethnicity [Hispanic/Latino]	0.37 (0.33)	1.44	[0.75–2.78]	0.27
	Level [Undergraduate]	0.32 (0.33)	1.37	[0.72–2.65]	0.34
	GPA	−0.14 (0.32)	0.87	[0.47–1.63]	0.66
Message	Intercept	−1.53 (1.62)	0.22	[0.01–4.56]	0.34
	Gender [male]	−0.70 (0.46)	0.50	[0.19–1.19]	0.13
	Ethnicity [Asian]	−1.36 (0.82)	0.26	[0.04–1.08]	0.10
	Ethnicity [Black]	0.68 (0.56)	1.98	[0.65–5.99]	0.22
	Ethnicity [Hispanic/Latino]	−0.16 (0.49)	0.86	[0.32–2.23]	0.75
	Level [undergrad]	−0.03 (0.50)	0.97	[0.37–2.69]	0.95
	GPA	−0.03 (0.45)	0.98	[0.42–2.42]	0.96
Recipient Processing	Intercept	−0.37 (1.16)	0.69	[0.07–6.64]	0.75
	Gender [male]	−0.59 (0.29)	0.55	[0.31–0.97]	0.04*
	Ethnicity [Asian]	0.02 (0.39)	1.02	[0.47–2.18]	0.96
	Ethnicity [Black]	−0.14 (0.42)	0.87	[0.37–1.99]	0.74
	Ethnicity [Hispanic/Latino]	−0.28 (0.33)	0.75	[0.39–1.45]	0.40
	Level [undergrad]	−0.29 (0.33)	0.75	[0.39–1.44]	0.39
	GPA	0.16 (0.32)	1.17	[0.63–2.20]	0.62

Gender, ethnicity, education level, and GPA as predictors of the proportion of codes regarding peer feedback by theme.

* $p < 0.05$, ** $p < 0.01$.

Values in parenthesis indicate the standard error. Values in brackets indicate the 95% confidence interval of odds ratio estimation. LL and UL indicate the lower and upper limits of the odds ratio.

Pat-El et al., 2012; Tuck, 2012). This finding further emphasizes the importance of building stronger student-teacher relationships and demonstrating expertise, as the student could reject even the most detailed and individualized feedback if their perception of the instructor were negative.

Finally, the context in which feedback was delivered accounted for the fewest codes. Rather than interpreting this result as minimizing the importance of context, we argue that structural and institutional factors, though present, are less evident to students. The lack of opportunity to apply feedback appeared as a recurring justification for rejection. Students often fail to recognize that even if they cannot implement feedback in the same assignment, it could still assist their learning and improve performance in future tasks. Therefore, providing students with opportunities to use feedback to revise their work is essential (Jonsson, 2013; Nicol et al., 2014). Additionally, the timing of feedback delivery matters greatly. Students value feedback that is delivered neither too early nor too late. While these issues are categorized under context, they fall within the instructor's command. When instructors are mindful of feedback timing and insert opportunities for revision in their practices, they can significantly enhance the effectiveness of feedback by increasing students' willingness to engage with it.

Our second research question focused on students' reasons behind their rejection of peer feedback. Neither inductive nor

deductive coding led us to create codes for "Context". It may be that because peers do not control the learning environment, there was no reason to assign responsibility in context.

In contrast to instructor feedback, the source emerged as a predominant theme in peer feedback rejection. Students frequently cited distrust in peers' intentions or expertise, perceiving peer feedback as less credible or valuable. These findings are consistent with previous research (e.g., Lam and Habil, 2020) that suggests students often mistrust their peer's ability to provide feedback or may perceive that their peers do not have sufficient expertise (Panadero, 2016). However, research consistently highlights the effectiveness of peer feedback in enhancing learning outcomes (Huisman et al., 2018; Simonsmeier et al., 2020). Thus, instructors should actively discuss the value of peer assessment in their classrooms and create opportunities for students to engage in meaningful feedback exchanges by encouraging students to regularly seek and provide constructive feedback.

Regarding the characteristics of the "Recipient," students focused primarily on their confidence in their performance and the perceived lack of value in the feedback provided by their peers. Participants frequently noted that peer review activities were often structured as class requirements rather than autonomous exchanges, which influenced their perception of the feedback's real utility. The compulsory nature of providing feedback led some

to doubt its sincerity or effectiveness in enhancing their work. This lack of autonomy diminished the perceived value of the feedback, as students felt it was given out of obligation rather than genuine intent to help. Interestingly, participants did not elaborate on individual characteristics in this context as much as they did in responses about instructor feedback. One possible explanation is that students had already described their personality and learning preferences when responding to the instructor feedback question, which immediately preceded the peer feedback question. Another potential reason is the more personal nature of peer interactions. Students may view their relationship with peers as one of shared responsibility, leading them to avoid assigning blame or acknowledging their own role in feedback rejection.

Similarly to the instructor feedback, issues with the message also contributed to peer feedback rejection. Ambiguity and negative tone were key factors, with students perceiving peer feedback as vague, broad, or judgmental. These findings suggest that students may benefit from training on how to provide specific, actionable, and respectful feedback.

Differences in reasons for feedback rejection related to student variables

In addition to exploring common themes in students' reasons to reject teacher and peer feedback, we also investigated whether students' responses varied as a function of students' characteristics (gender and educational level). The findings revealed interesting gender and academic level differences in students' reasons for rejecting teacher and peer feedback. For teacher feedback, female participants were less likely than male students to cite negative feedback tone and lack of value/utility as reasons for rejection, suggesting they may have a greater tolerance for tone or utility-related concerns. However, females were more likely to reject teacher feedback due to inaccuracies, indicating a potential heightened critical view of feedback quality.

In regards to peer feedback, gender differences were also found; females were less likely to attribute rejection to a lack of peer expertise, possibly reflecting greater trust in their peers' abilities. Interestingly, contrary to the teacher findings, female students were more likely than males to cite negative tone as a reason for rejecting peer feedback, emphasizing the importance of respectful and supportive communication in peer interactions. Previous literature also identified differences in male perception of peers: females valued peer assessment more than males (Rotsaert et al., 2017). Gender differences in the feedback experience overall have been evident since at least the nineties (Vattøy et al., 2021), and came up in other themes to be discussed in upcoming subheadings. These differences highlight the importance of considering diverse student characteristics when tailoring and delivering feedback. For instance, ensuring feedback accuracy and specificity may be particularly important for fostering acceptance among female students.

As for educational level, significant differences in reasons for rejecting feedback were also noted. For teacher feedback, undergraduate students were more likely than graduate students to cite a lack of value/utility as their reason for rejection, reflecting potential challenges in understanding the relevance or

applicability of feedback at earlier stages of academic development (Lipnevich and Lopera-Oquendo, 2022). In contrast, graduate students more frequently cited negative feedback tone and negative affect as reasons for rejection, suggesting heightened expectations for professionalism and emotional support in feedback as they progress in their academic careers. Similarly, in peer feedback, graduate students were more likely than undergraduates to cite negative affect as a reason for rejection, which suggests greater emotional investment that graduate students may place in feedback interactions (Agius and Wilkinson, 2014).

The predictive analyses provided additional insights into the factors influencing feedback rejection. While we did not find any significance related to the rejection of teacher feedback, gender appeared as a significant predictor for rejecting peer feedback, with males being more likely to cite source-related reasons, such as a lack of trust or expertise in their peers, whereas females were more likely to reject feedback due to recipient-related factors, such as confidence in their own performance or perceived value of the feedback. These findings suggest that male students may focus more on external attributes of the feedback provider, while females may prioritize their internal perceptions of feedback relevance.

Limitations and future directions

While this study was exploratory, several limitations should be acknowledged. First, our sample consisted solely of post-secondary students from various colleges within a large public university in the northeastern United States, limiting the generalizability of our findings to broader student populations. Future research should examine feedback rejection across diverse educational contexts, including secondary schools and international institutions, to provide a more comprehensive understanding.

Second, the prompts required participants to recall past events, which may not have captured the full range of their feedback rejection experiences. Future studies could incorporate real-time data collection methods, such as experience sampling or diary studies, to reduce reliance on retrospective self-reporting.

Third, the prompts were broad and open-ended, allowing participants to interpret the term "feedback" in their own way. While this approach provided valuable insights, it also introduced variability in responses. Future research could refine prompts to ensure greater consistency while still allowing for individual perspectives.

Finally, the reliance on written language production may have posed challenges for non-native speakers or individuals with language-based differences. Future studies should explore alternative data collection methods, such as interviews or multimodal responses, to accommodate a wider range of participants and ensure inclusivity in feedback research.

Implications

Based on the findings of this exploratory study, we propose several next steps for enhancing feedback practices and advancing teacher professional development.

- *Context*: Institutions should provide teachers with ample time to provide feedback so students have the time to implement it. Providing guided opportunities for peers can enhance their feedback-giving skills, making them a more valued source;
- *Source*: The student-teacher relationship is an important aspect of feedback, and teachers should work on establishing a positive rapport with their students while demonstrating their content and pedagogical expertise. Since peers are seen as untrustworthy or lacking expertise, some steps may help alleviate these problems: assigning peers to provide feedback could be an ungraded task so that they do not feel compelled to be unnecessarily critical, and they can be given rubrics to use as guides for feedback;
- *Message*: The feedback message is often rejected due to being ambiguous and having a negative tone. With this in mind, it needs to precisely respond to student work, be actionable, and provide a genuine tone of support. This applies to both teacher and peer feedback;
- *Recipient*: Knowing how to recognize and adapt to students' different personalities and motivations will allow teachers to tailor feedback appropriately. This would require institutional practices and professional development that enhance and support interpersonal communication skills;

Conclusion

In conclusion, the dynamics of feedback rejection differ significantly based on the source of the feedback. Teacher feedback is primarily rejected due to issues related to the message or the student, whether it is clarity, relevance, or the student's emotional and cognitive responses. In contrast, peer feedback is overwhelmingly about the source, with students questioning the credibility, expertise, or value of their peers' input. This distinction underscores each feedback context's unique challenges and the need for tailored strategies to address rejection effectively.

Equally compelling are the gender and academic level differences, which remain underexplored in the broader discussion. Gendered patterns in emotional and cognitive responses to feedback suggest that male and female students may perceive and act on feedback differently, influencing rejection rates and engagement. Academic levels further complicate the picture, as younger or less experienced students may struggle more with decoding and accepting feedback compared to their senior counterparts. Addressing feedback rejection requires a nuanced understanding of these intersecting factors (i.e., source, message, gender, and academic level), paving the way for more targeted, equitable, and effective feedback practices.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by QC-23452023 Protocol of QC and GC, CUNY. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

AL: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Writing – original draft, Writing – review & editing. CL-O: Formal analysis, Methodology, Software, Writing – original draft. LT: Methodology, Writing – original draft. JG: Data curation, Visualization, Writing – review & editing. CF: Data curation, Writing – review & editing.

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Supplementary material

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Making student voice heard in dialogic feedback: feedback design matters

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Introduction: Making student voice heard is crucial for productive feedback. However, this is seldom in practice in the exam-oriented context because students lack opportunities and support to give voice in feedback processes. To bridge the gap, this collaborative action research explored how feedback could be redesigned to invite student voice in a Singapore secondary school.

Methodology: We collaborated with three Social Studies teachers to transform their error-focused practice into dialogic feedback accentuating student voice. Drawing on the Lundy model of participation and self-determination theory, the teachers designed a feedback log to let 48 secondary four (equivalent to Grade 10) learners articulate their voice and psychological needs for competence and relatedness.

Results: Analysis of feedback logs, student focus groups and teacher interviews indicated three main aspects of student voice: (i) grades (numeric feedback) as an indicator to monitor one's goal achievement and exam preparation efforts; (ii) challenges in making feedforward; and (iii) learners' feedback engagement and motivation largely shaped by teacher response.

Discussion: Given the context-dependent nature of tasks in Social Studies, verbal reciprocal exchange would be useful in developing students' higher-order thinking skills for feedforward. Implications for productive feedback designs are discussed, and avenues for future research outlined.

KEYWORDS

student voice, dialogic feedback, feedback design, exam-oriented context, school

1 Introduction

Feedback is a dialogic process in which students and teachers participate actively in reciprocal exchange to clarify assessment standards, discuss performance gaps, and develop improvement plans for academic regulation (Carless, 2012; Steen-Utheim and Wittek, 2017). An understanding of student voice in dialogic feedback is essential because “without the learner's perspective the crucially important affective and interactional aspects of learners' responses to feedback are likely to be missing” (Hargreaves, 2013, p. 230). By heeding student voice, teachers could diagnose and address learners' needs, increase their learning interest and responsibility, and establish a caring and supportive classroom atmosphere (Plank et al., 2014).

Notwithstanding the importance of student voice, the field lacks a widely accepted definition to guide empirical investigations. Rudduck and McIntyre (2007) see student voice as students' perspective on the things that influence their learning or matter to them in the instructional process. Cook-Sather (2006) defines it as students' say in education-related decision-making where they have “the opportunity to speak one's mind, be heard and counted by others, and, perhaps, to have an influence on outcomes”

(p. 362). Though both interpretations indicate varying degrees of engagement, they are not mutually exclusive in examining students' dialogic feedback experiences because productive feedback is predicated on a substantial student role (van der Kleij et al., 2019) whereby students exercise agency to decide the focus of dialogue, convey their perspective, and partner with teachers to construct improvement suggestions (Carless, 2020; Matthews et al., 2023). To take note of this point, we conceptualize student voice in feedback as learners' active involvement in expressing their feedback needs, understanding of feedback, and thoughts about performance improvement.

Feedback practices in exam-oriented societies tend to be teacher-centered and focus on error corrections (Lee and Coniam, 2013; Tay and Lam, 2022). Such orientation restricts student role and voice in feedback processes. Despite Plank et al.'s (2014) call for examining student role in feedback, van der Kleij et al.'s (2019) meta-review indicates that the increasing recognition of dialogic feedback is not accompanied by ample research evidence on how to elicit and strengthen student voice. To bridge the gap, we aim to explore how feedback could be redesigned to invite student voice in a Singapore secondary school. The research questions are shown below. The significance of this paper lies in unpacking student voice in feedback and giving recommendations for redesigning feedback in the exam-oriented context.

RQ1. What is student voice in feedback?

RQ2. How do teachers respond to the student voice?

RQ3. How do students and teachers perceive the effectiveness of the redesigned feedback practice?

2 Student voice in feedback

2.1 Student role in feedback processes

The feedback practices in the high-stakes assessment environment are usually characterized by extensive error corrections, concurrent release of grades and comments, and provision of improvement suggestions (Lee and Coniam, 2013; Tay and Lam, 2022). Though students could ask questions about teacher feedback and seek additional support, teachers are the key driver determining the goal and content of feedback interaction (van der Kleij et al., 2019).

The teacher-centered feedback practice may limit students' role. When the emphasis falls on knowledge acquisition and grades, they may perceive teachers as the authority in assessment and teachers' improvement advice as a short cut to boosting performance (Tan and Wong, 2018). Once they are accustomed to this approach, they may not recognize the need to self-evaluate performance, self-generate feedback and improvement plans. The comprehensive error corrections may also undermine their emotional wellbeing and discourage their engagement with feedback (Lee and Coniam, 2013). Furthermore, not all students could get usable and personalized feedback as teachers do not understand individual learners' needs (Ratnam-Lim and Tan, 2015). In the circumstances, they may find feedback unable to address their needs and thus lose the motivation to engage with it.

To strengthen students' role in dialogic feedback, Winstone et al. (2017) put forward the development of proactive recipience—seeking, interpreting and enacting feedback for academic regulation. At the core of proactive recipience is students' motivation to participate in feedback dialogue (van der Kleij et al., 2019). Three elements are vital for dialogic feedback: (i) unpacking success criteria to enable students' self-evaluation of performance and understanding of teacher feedback; (ii) opportunities for students to articulate expectations and interpretation of feedback; and (iii) teacher response to students' feedback needs (Adie et al., 2018). While the first element is evident in exemplar analysis, explanation of rubrics and checklists (e.g., Lee and Coniam, 2013; Tay and Lam, 2022), there has been a dearth of research looking into students' expression of voice and teachers' response to it.

2.2 Theoretical underpinnings

Our research is theoretically grounded in the Lundy model of participation (Lundy, 2007) and self-determination theory (SDT) (Ryan and Deci, 2017, 2020).

2.2.1 Lundy's model of participation

Lundy's participation model is developed to implement Article 12 of the United Nations Convention on the Rights of the Child (UNCRC). This article stresses children's rights to express views freely in matters influencing them and their views to be given due weight in accordance with their age and maturity (Lundy, 2007). At school, the rights grant young learners who can formulate their own views the autonomy to participate in decision-making during the instructional process. Yet, their level of involvement could be influenced by tokenism (one's views not taken seriously by teachers) and power imbalance (Reynaert et al., 2009). Some in Confucian-heritage settings may eschew expression of voice due to the cultural values, for example deferring to teachers' judgments, favoring collectivism over individualism, and avoiding disclosing one's inadequacies for face-saving (Carless, 2011; Chong and McArthur, 2021). Hence, it is critical for teachers in such settings to highlight the benefits of voice articulation at the outset of feedback processes.

Lundy's (2007) model comprises four elements in upholding children's rights: (i) space (providing a safe and respectful environment and an opportunity for children to express views freely); (ii) voice (facilitating their expression of views); (iii) audience (individuals with decision-making power hear the children's views); and (iv) influence (acting upon their views when appropriate). In the context of feedback, space means students have psychological safety and the opportunity to state their feedback needs and understanding (Johnson et al., 2020). Voice refers to teachers' cognitive and affective scaffolding to aid students' articulation of views, for instance using prompts to guide students' identification of needs (Fletcher, 2018) and developing their confidence in communication (Steen-Utheim and Wittek, 2017). Audience points to the importance of teachers to listen to student voice and taking their voice seriously, and influence

involves teachers responding to their voice accordingly (Matthews et al., 2023).

2.2.2 Self-determination theory

While the participation model offers a lens to examine student voice, it does not address learner motivation in feedback processes. SDT fills the gap by emphasizing that students are motivated to learn if their psychological needs for autonomy, competence and relatedness are satisfied (Ryan and Deci, 2017, 2020). In relation to feedback, autonomy refers to students' volition to seek feedback and their decision to engage with it for academic regulation. Competence pertains to their feeling of capability in reaching their desired goals. Relatedness concerns their affective connection with teachers and peers, and the care and respect experienced in interaction. To enhance their motivation and psychological wellbeing, teachers could provide autonomy support to meet their psychological needs. This involves (i) giving students choices and opportunities to initiate feedback, (ii) explaining the rationale for feedback practice, (iii) acknowledging their emotions, achievements and improvements with positive feedback, (iv) offering task-related assistance to increase their self-efficacy, and (v) demonstrating empathy, respect and trust in feedback communication (Niemic and Ryan, 2009; Zhang et al., 2024).

From the SDT perspective, students may lack intentionality to engage with feedback (amotivation) if they find it not useful to learning, or the given feedback does not satisfy or dents their self-ego. They are intrinsically motivated when they find enjoyment and satisfaction from feedback processes. Between amotivation and intrinsic motivation, they could be extrinsically motivated by external incentives such as grades (numeric feedback), praises or criticisms. Depending on the motive and their way of reaction, they could have different subtypes of extrinsic motivation (Niemic and Ryan, 2009; Ryan and Deci, 2020): (i) external regulation (motive driven by rewards or punishment); (ii) introjection regulation (motive driven by one's intent to satisfy or protect self-ego); (iii) identified regulation (motive driven by one's perceived importance or value of the behavior); and (iv) integrated motivation (motive driven by the behavior consistent with one's abiding values and interests). For example, grades (external motive) usually impose external regulation and demotivate underachievers because numeric feedback hurts their self-esteem and provides no specific information for performance advancement (Hattie and Timperley, 2007; Lipnevich and Smith, 2009). Nevertheless, students with high achievement orientation could internalize extrinsic motivation and become identified regulated when they use grades to monitor learning progress and modify their study behaviors accordingly for goal fulfillment (Alhadabi and Karpinski, 2019; To et al., 2023a). There are also cases of introjection regulation where students use teacher feedback to confirm their self-evaluation of performance (Mulliner and Tucker, 2015; Pricinote et al., 2021).

2.3 Pertinent studies and research gaps

To our knowledge, not many studies have explored the connection between feedback design and student voice. From our

careful review of literature, we manage to identify three pertinent studies in the school context. The first study is the use of a project planning guide to facilitate primary students' initiation of feedback dialogue (Fletcher, 2018). To prepare them for an English writing project, their teachers discussed the planning guide to help them understand success criteria, set task goals and choose appropriate task strategies. After they had written an initial draft, they self-assessed performance using a checklist, identified their strengths and weaknesses, explained their achievements and problems, and sought feedback. With an understanding of their self-assessment and feedback needs, their teachers gave response in group meetings where students with similar problems could clarify issues and brainstorm strategies with their peers and teachers for subsequent draft enhancement. Through interviews and analysis of their project planning guides and writing samples, Fletcher (2018) ascertained that teacher scaffolding and the self-assessment enabled students' articulation of voice. The interaction in the feedback meetings allowed teachers to customize support and to foster relatedness with students.

The second one is van der Kleij's (2020) Feedback Engagement Enhancement Tool (FEET) to increase secondary school students' engagement with feedback. Throughout a 3-week trial in an English writing class, the students documented four types of information on a FEET booklet in preparation for a summative assignment: (i) all written and oral feedback from teachers, peers and students themselves and the emotions triggered by the feedback; (ii) their interpretation of feedback and statement of feedback needs; (iii) self-developed improvement plans; and (iv) reflections on their improvement actions. Teacher interviews, student focus groups and their FEET booklets showed that acknowledging students' emotions of feedback could encourage their engagement. The FEET tool enhanced students' agentic role and provided a basis for teacher-student feedback exchange. However, only high proficiency students were able to internalize the feedback given, seek additional feedback, and generate an improvement plan. van der Kleij (2020) concluded that more reflective skills training would be useful to aid students in turning external feedback to self-initiated improvement plans.

The third one is the employment of a self-assessment form to enable secondary school students' articulation of targeted performance level and improvement plan (To et al., 2023b). Embedding the feedback practice in the draft-plus-rework design for an oral presentation task, a team of Malay Language teachers explained the rubric, engaged students in audio exemplars of presentation, and arranged reciprocal peer assessment after students' production of initial presentation. Upon reflecting on the peer feedback, they stated their performance goal, aspects to be improved in the enhanced presentation, and improvement plan on the self-assessment form. Following their production of enhanced presentation, the teachers commented on goal achievement, presentation quality, and improvement plan. While the study mainly explored teacher feedback literacy development, the teachers' reflective journals and focus groups revealed that the feedback design gave students autonomy in the assessment process. The rubric explanation, exemplars discussion and teachers' comments on their self-assessment served as useful autonomy support to address their psychological need for competence.

The synthesis of the three studies indicates four feedback design principles for eliciting student voice. First, all the designs grant students some decision-making power, ranging from determining the focus of dialogue (Fletcher, 2018) and devising improvement plans (van der Kleij, 2020; To et al., 2023b). This enhances their feedback responsibility and fulfills their psychological need for autonomy. Second, all have a written artifact to facilitate students' expression of voice, for example the project planning guide (Fletcher, 2018), FEET (van der Kleij, 2020), and self-assessment form (To et al., 2023b). This is important as externalizing one's affect, cognition and metacognition catalyzes academic self-regulation (Nicol and McCallum, 2022) and aids teachers' understanding of learners' needs. Third, all emphasize teacher scaffolding to support students' generation of self-feedback. Such scaffolding encompasses rubric explanation to unpack success criteria (Fletcher, 2018), exemplar analysis to sharpen academic judgment (To et al., 2023b) and training to derive reflective insights from external feedback (van der Kleij, 2020). Fourth, teachers have an opportunity to respond to student voice through feedback meetings (Fletcher, 2018) or written comments (To et al., 2023b). This demonstrates that student voice is taken seriously.

Although the reviewed studies have illustrated the principles for feedback designs, there are still unanswered questions. Since the three studies are contextualized in language subjects, the feedback designs may not fit non-language subjects because of variations in discipline-specific feedback practices (Carless et al., 2023; Quinlan and Pitt, 2021). Moreover, few studies have systematically analyzed student voice and teacher response to it. This warrants scrutiny because teacher response carries potential in influencing students' confidence and volition to seek additional feedback (Plank et al., 2014). Furthermore, scant literature has compared students' and teachers' perceptions of feedback designs. If both parties have shared responsibility in productive feedback, it is essential to examine the differing perceptions so that feedback could be redesigned for mutual benefit.

3 Method

3.1 Research approach

We employed the collaborative action research approach as teachers could be empowered as the change agent to reshape their existing power structure and feedback practice under researchers' support (Burns, 1999). Through school-university collaboration, we could achieve praxis by considering the practicalities of feedback design principles (Banegas et al., 2013). In this study, our teacher participants redesigned, implemented and reflected on the feedback practice. We enlightened them on feedback design principles and examples and facilitated their meaningful reflective dialogue at different time points in the research process.

3.2 Sociocultural context

Our study was situated in Singapore, an exam-oriented society where students' nationwide examination results at the end of primary and secondary education influence their school placement and future career prospects. Unsurprisingly, the high-stakes

examinations not only exert intense stress on students and their parents but also influence school-based assessment at all levels by focusing students and teachers on national examination preparation (Tan, 2011). For example, primary school students are taught how to “scaffold” their language compositions with memorized phrases and suggested formats in adherence to scoring rubrics. It is customary for teachers to use drilling or practice tasks to hone students' exam-taking skills and to correct all students' errors to reduce reoccurrence in examinations (Wong et al., 2020).

To mitigate negative washback, the Ministry of Education (MOE) has made strenuous efforts to balance high-stakes summative assessment with more formative use of assessment in schools. In 2008, the MOE introduced “Holistic Assessment” and encouraged primary schools to provide more qualitative feedback for improvement and to design “bite-sized” assessment as an alternative to one-off examinations, with the purpose of reducing assessment stress and test anxiety (Ministry of Education, 2019). However, teachers reported challenges in couching feedback that could be understood and acted upon by students. Designing bite-sized assessment tasks seemed to create more frequent occurrences of assessment and consequently more stress for students and teachers (Ratnam-Lim and Tan, 2015). The study by Deneen et al. (2019) further showed that secondary school teachers seemed to value formative assessment but perceived a lack of assessment literacy and opportunities to practice it. A more recent initiative involved scrapping mid-year examinations at all school levels from 2023 onward (Ministry of Education, 2022). Nevertheless, despite all these initiatives, examination preparation remained important in teaching and learning. Developing a feedback pedagogy suitable for this high-stakes assessment environment becomes the main mission of educators in Singapore.

3.3 School context

This study was conducted as part of our funded research on “a pedagogy of feedback” in the 2023 academic year.¹ We adopted criterion sampling (Suri, 2011) for school selection. The three criteria included (i) one of the school development areas relevant to students' feedback engagement; (ii) Principal's support to school-university collaboration; and (iii) teachers' strong commitment to professional development. In the pursuit of excellence and innovation in teaching, the Principal encouraged each subject team to undertake a professional inquiry of their own interest for pedagogical or assessment advancement every year. Upon explaining our research to all Department Heads, the Social Studies team saw an overlap between our project and their professional inquiry and so expressed interest in collaboration.

After communication and coordination work in Term 1, we had regular meetings with the subject team in Term 2 to understand their problems in the original feedback practice and to discuss feedback redesign. To furnish the team with professional support, we explained the importance of attending to student voice, shared

¹ In Singapore, there are four school terms in a year (Term 1: early January to mid-March; Term 2: mid-March to late May; Term 3: late June to early September; Term 4: mid-September to late November). Each term lasts for ~10 teaching weeks.

TABLE 1 Profile of teacher participants.

Name (pseudonym)	Gender	Nationality	Years of teaching experience	Feedback beliefs
Amy	Female	Singaporean	12	Feedback is not to give students a straight answer, but a reflective teaching and learning process to help them identify learning gaps, communicate with us and work on areas for improvement.
Johnson	Male	Singaporean	10	Feedback should be targeted and highly contextualized to the task. Our feedback should challenge students in the thinking process, so we create the thinking wheel to make them consider different aspects when attempting the task.
Philip	Male	Singaporean	3	Feedback helps students understand the gap and know how to close it. In the context of Social Studies, our feedback states whether they have understood sources appropriately and whether they are responding to the question as intended. Our feedback also enables them to see things from a different perspective—the way to improve critical thinking.

the feedback designs of Fletcher (2018), van der Kleij (2020) and To et al. (2023b) and the design principles in Section 2.3, facilitated their reflections on the original practice, and gave advice on the redesign. The meetings were facilitated by the first and third authors who possessed rich experience in feedback research and teacher professional development in the exam-oriented context. The feedback redesign was implemented and evaluated in Term 3. No professional and research activities were performed in Term 4 as the team and students were busy preparing for the school's year-end and nationwide exams.

3.4 Participants

The Social Studies team consisted of three teachers. They had a high level of assessment literacy to improve students' feedback uptake. Table 1 shows each teacher's profile and feedback beliefs. The team decided to reform the feedback practice in Secondary 4 (equivalent to Grade 10) classes as they wished to increase students' feedback uptake before the General Certificate Education Ordinary Level (GCE O-Level) exam at the end of Secondary 5. The feedback redesign was implemented to all six classes (192 students in total, 32 per class on average) in Term 3. They and their parents chose to participate in the study after we had explained the project objective and data collection procedure. Finally, forty-eight students agreed to participate in the study. The non-participants still received teacher feedback under the redesigned practice, but no data were collected from them.

To prepare for the GCE-O Level exam, the students worked diligently and regarded every practice task as an opportunity to advance their subject knowledge and exam-taking skills. They expected to know marks, strengths and weaknesses in performance and improvement suggestions so that they could review their efforts for exam preparation. During Secondary 1–3, they had been trained to self-evaluate performance using a checklist, but they were not required to discuss their self-assessment and understanding of feedback with teachers. So, articulating voice in feedback processes was a novel experience to them.

3.5 Original feedback practice

Prior to this project, the team utilized the teacher-centered, error-focused feedback approach to source-based case study

questions (one of the task types in the GCE O-Level exam). For task preparation, the team first used exemplars to illustrate task structure and success criteria and then gave students a checklist for self-assessment. During grading, the team put down marks and written comments on students' task sheets. Since the case study questions assessed analytical, critical thinking and perspective taking skills, the team identified students' problems with skills acquisition and used questions to stimulate in-depth thinking. This was followed by an in-class explanation of students' major problems and recommendations for skills enhancement. The students were not required to revise their work because the team believed that more practice on different topics would be more useful for learning. In case individuals had questions about the task or feedback, they could consult their teachers outside class.

Upon reflection, the team opined that the feedback practice was ineffective due to students' recurring problems in subsequent tasks. The team ascribed their limited feedback uptake to two reasons. First, most students did not understand the skills-focused feedback and thus were unable to generate improvement plans. Second, only high-achieving students sought clarification and discussed improvement suggestions with teachers. The team speculated that this may be due to students' lack of motivation, opportunity or readiness to discuss learning issues with teachers. Without an understanding of individuals' needs, it was hard for the team to provide personalized feedback to scaffold learning. Hence, the team redesigned the practice in order to facilitate their expression of feedback needs and understanding of skills-focused comments and to encourage feedforward.

3.6 Redesigned feedback practice

Taking the second design principle in Section 2.3, the team developed two written artifacts for the feedback redesign: (i) a feedback log (Figure 1) to enable students' articulation of voice; and (ii) a thinking wheel (Figure 2) to help them recognize the higher-order thinking skills expected of the task. In the redesigned practice, the students had the opportunity to express voice before and after task submission. Figure 3 depicts the involvement of teachers and students in feedback processes.

Prior to task submission, the teachers applied the third design principle and scaffolded students' goal setting and self-reflections with two strategies. First, the class discussion of a checklist and an exemplar worksheet helped students unpack success criteria,

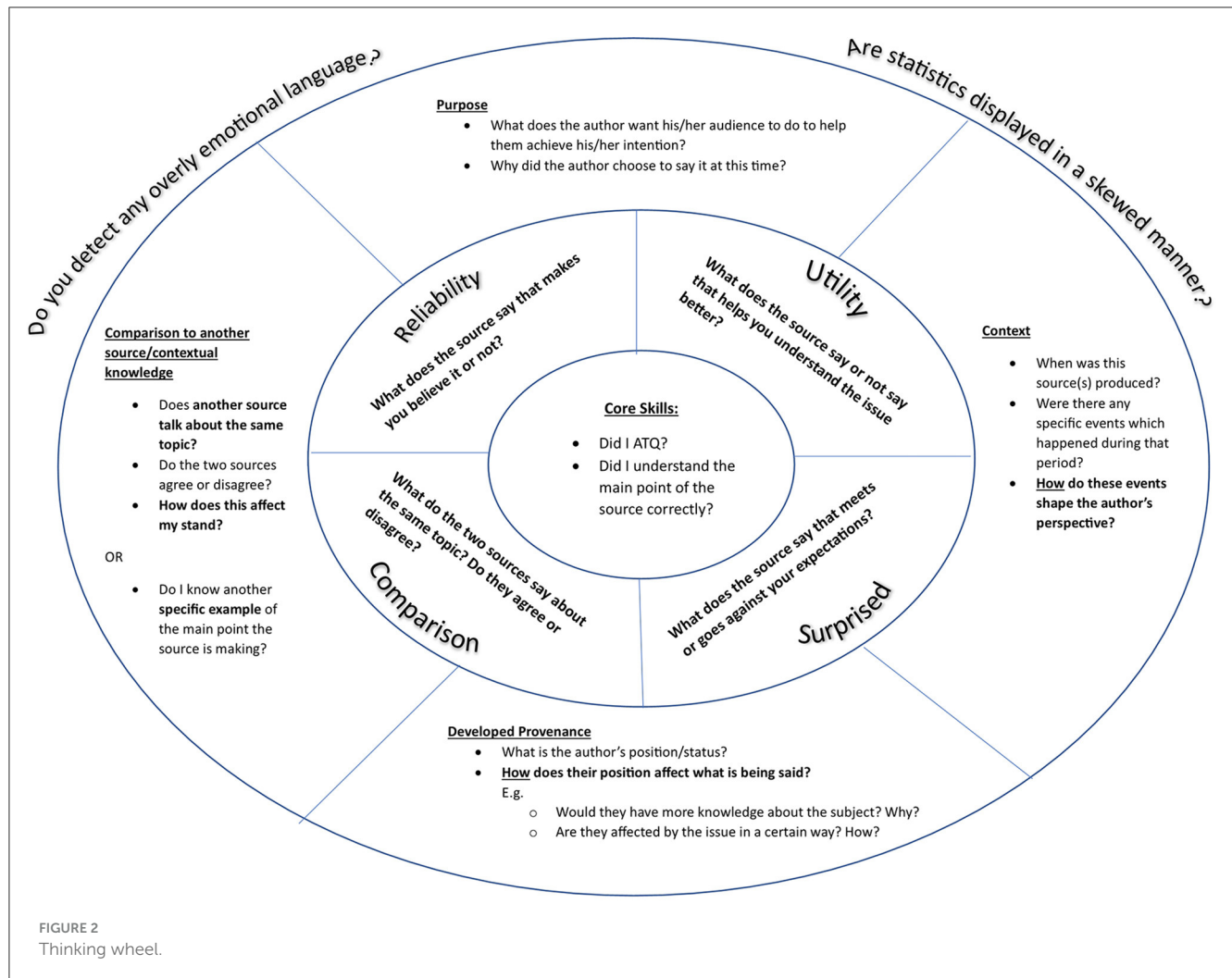
FIGURE 1
Feedback log.

After task submission, the teachers read individual students' task response, commented on their performance and goal fulfillment, and responded to their reflections in Section 4 (the fourth design principle). The teachers put a tick on concentric circles (a miniature thinking wheel) to indicate whether the given comments related to core skills (inner ring), analysis of source content (middle ring) or routes to critical thinking (outer ring). In view of the impact of marks on emotions (Hattie and Timperley, 2007), the teachers withheld students' results to make students engage with the feedback. Following the receipt of the comments, the students underwent four cognitive and metacognitive processes: (i) making sense of teacher feedback on goal fulfillment, self-reflections and performance; (ii) identifying their own performance gaps; (iii) putting down their understanding of teacher feedback in Section 5; and (iv) outlining what to do in

The drafting of the improvement plan was not mandatory because the teachers foresaw that not all students were able to describe their plan in writing. For those producing an improvement plan, the teachers would comment on its appropriacy. For those without a plan, teacher suggestions would be given. In the subsequent lesson, the teachers summarized students' key strengths and weaknesses, indicated improvement directions, and released their marks. They could approach their teachers to clarify comments or continue the discussion of improvement plans outside class.

Our data collection methods included documentation of feedback logs, student focus group discussions (FGDs) and semi-structured teacher interviews.

We collected feedback logs at the end of Term 3 to analyze student voice in feedback processes. We adopted this method because documentation enabled us to gather data without intervening feedback interaction and to corroborate evidence from FGDs and teacher interviews (Bowen, 2009). As shown in Figure 1, the feedback log offered students space to articulate task goals and self-reflections, express understanding of teacher feedback, and state their plan for the next task. The log also



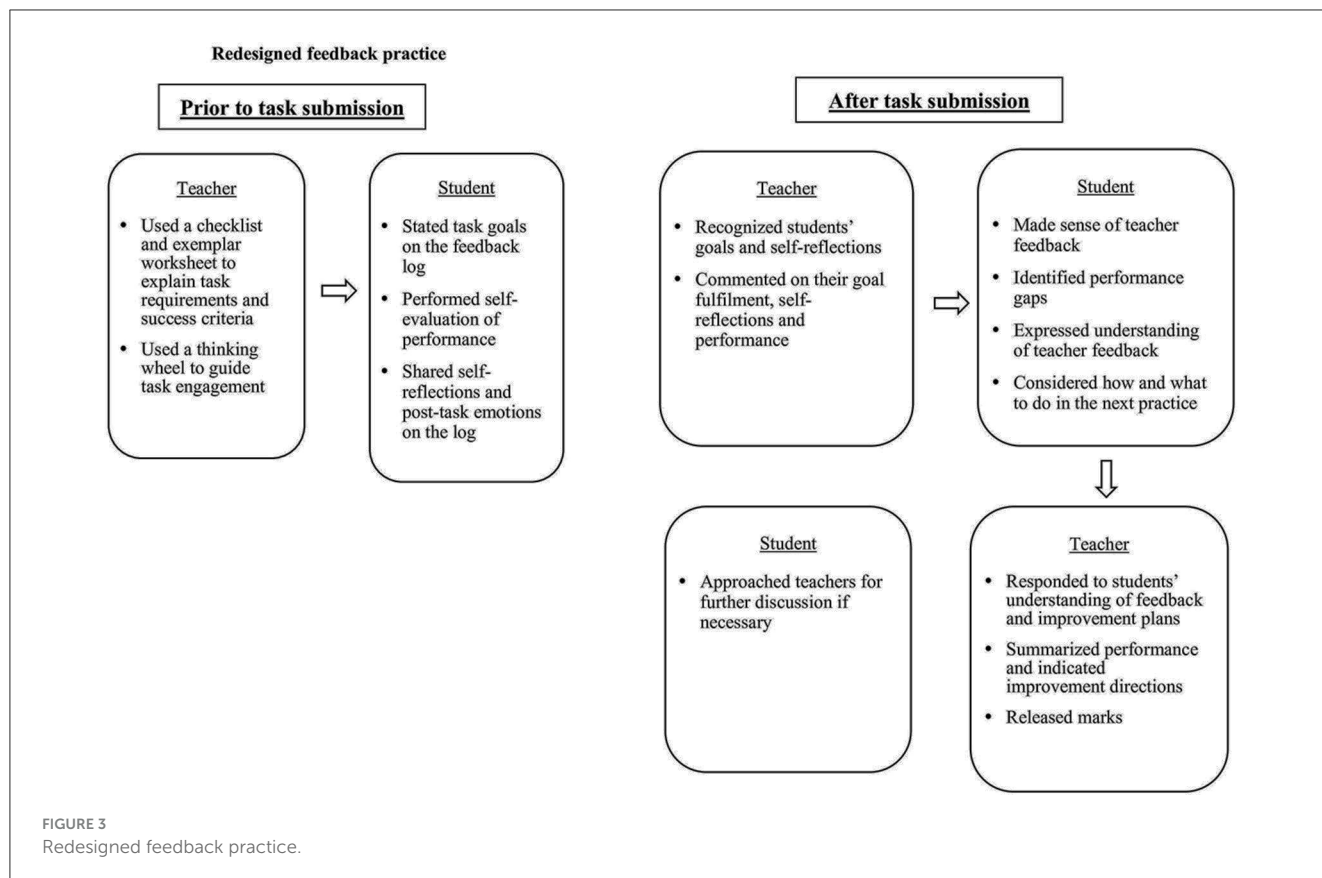
documented individuals' task response and teacher comments on their self-assessment and performance. There was no word limit for student voice, so they could freely expound their views in English. To protect their anonymity, upon collecting the scanned copies of the logs, we removed individuals' identification information and assigned a pseudonym for each student.

We conducted FGDs to explore students' cognitive and emotional experiences of feedback and their perceived effectiveness of the feedback redesign. This cost-effective method allowed us to dig into diverse students' perspectives of the redesigned practice. The group dynamics among students could stimulate new thoughts and reduce researchers' influence during data collection (Lederman, 1990). In the final week of Term 3, 12 students in three FGDs (three in each FGD) shared their interpretation of teacher feedback and opinions about the feedback redesign. During the FGDs, the first and second authors showed individuals' feedback logs and invited them to explain their thoughts and feelings in feedback processes. We then facilitated a discussion of how the redesigned practice had shaped their feedback uptake and what factors came into play. All FGDs were carried out in English and recorded for analysis. Each took ~45 min. Appendix A lists the FGD questions.

We carried out two interviews to understand the team's development of the feedback redesign and facilitate reflections. The first interview was conducted at the outset of Term 2 to delve into individual teachers' feedback beliefs, the original feedback practice and problems encountered. This helped us understand the team's professional development needs and offer necessary support. The second one was performed after the implementation of the feedback redesign. We asked the team to discuss the strengths and weaknesses of the feedback redesign, challenges in responding to student voice, and possible ways to improve the redesigned practice. To compare student and teacher perspectives, we then invited them to convey their views on the themes emerged from the FGDs, for example understanding of given feedback, provision of marks, and development of improvement plan. Both interviews were done in English and recorded for analysis. The first one lasted for 40 min, and the second one 70 min. Appendix B shows the interview questions.

3.8 Data analysis

To answer the research questions, we drew on Braun and Clarke's (2006) thematic analysis methods to analyze the



feedback log, FGD and interview data. Since limited research has systematically studied student voice in feedback, our analysis was mainly inductive.

To analyze the feedback logs, the first author examined each student's goal, self-reflections, understanding of teacher feedback and plan for the next task. Then, she performed *in vivo* coding, and combined similar codes into themes. For instance, the self-reflection statement "I am still unfamiliar with reliability" was coded as "unfamiliar with reliability," and another statement "It was difficult to understand the major argument of Source C" as "difficult to understand source materials." Both codes were subsumed under the theme "reveal inadequacy." Following iterative reviews of the themes by the other authors, we confirmed nine themes under four aspects of student voice. For data display, we compiled Table 2 in Section 4.1 to showcase all the themes and their illustrative examples. The main challenge in analysis involved categorizing teacher response to student voice because the response varied according to individual learners' goals, performance and other factors. To capture the complexity of reciprocal exchange, we identified three feedback vignettes to depict student-teacher interaction in a combination of circumstances.

To analyze the FGD and interview data, the second author read the transcripts, extracted quotes pertinent to student voice and the perceived effectiveness of the feedback redesign. Then, she reexamined the identified chunks, labeled them with *in vivo* codes, and grouped codes with similar meanings into themes. Afterward, the first author reviewed the set of candidate themes iteratively to check for data relevancy. In case of alternative interpretation, all

authors reread the data, clarified our views, and reached consensus through discussion.

For data triangulation, we juxtaposed the data from the feedback logs, FGDs and interviews to look for data patterns emerged from the findings. We also compared students' and teachers' perceptions of the feedback redesign on a role-ordered matrix (Miles and Huberman, 1994) for a comprehensive examination of opinions. When spotting dissimilarities, we contemplated the possible factors for the differences. Any nuanced understanding about student voice in feedback was recorded on a theoretical memo (Urquhart, 2013) to aid our generation of significant insights.

3.9 Research ethics and trustworthiness

Prior to data collection, we obtained ethical clearance from National Institute of Education, Nanyang Technological University² and Singapore Ministry of Education. We also gained consent for data use for research and publication from the Principal, Social Studies teachers, students and their parents. Students were informed that their decision to participate in the study would not influence their assessment results. They could choose to withdraw from the study anytime without

² All the authors worked at National Institute of Education, Nanyang Technological University when the research was undertaken.

TABLE 2 Student voice in feedback.

Aspect	Category	Example
Task goals	Task structure	• Write two well-structured paragraphs. • Have a clear stance and supporting evidence in the task.
	Skills application	• Answer that question with cross-reference to another source. • Compare the sources and make my points clear.
Self-reflections	Express satisfaction about task performance	• I think this is the best practice I've done so far. • I did well in critical thinking as I considered the context and purpose when deciding my stance.
	Review time management skills	• I spent too much time reading both sources to get the main ideas. This wasted lots of time. I should have limited reading time to 5 min in exam.
	Reveal inadequacy	• I am still unfamiliar with reliability. • Hard to infer the purpose of source readings. • Don't know how to compare source materials and use their ideas to support my stance.
	Express uncertainty	• Not sure if paragraphs are well-elaborated. • Can I understand the source materials correctly?
Understanding of teacher feedback	Recognize problems	• I know I did not have enough evidence to justify my analysis. • I understand that I did not do a good job in performance.
	Seek clarification	• Cross-reference. I don't know whether to add reason in my content. • Is it necessary to evaluate each source reading?
Plan to do in the next practice	Make improvement suggestions	• I think I could've annotated the source to help me link to other factors like job opportunities. • Read the source materials more carefully and think about the connection between the key points when making cross-reference.

any consequences. Pseudonyms were used when we reported individuals' experiences and views in the feedback vignettes and quotes.

To enhance the trustworthiness of the study, we observed credibility, transferability and managing subjectivity in analyzing and reporting the findings. We maintained credibility by triangulating the data from different sources to see whether the feedback design was implemented in the way described by the participants. We also explored the effectiveness of the redesigned practice from students' and teachers' perspectives. For transferability, we heeded [Nunan and Bailey's \(2009\)](#) advice to help readers see the connection between our findings and their situated context. This was achieved through a 'thick description' ([Merriam, 1998](#)) of the sociocultural and school settings in Sections 3.2 and 3.3, a detailed explanation of the original and redesigned feedback practices in Sections 3.5 and 3.6, and our discussion of findings in relation to other studies. We managed subjectivity by confining our involvement to professional development support and facilitation of teachers' reflections. We also developed researchers' reflexivity by keeping a theoretical memo ([Urquhart, 2013](#)) to note down unexpected discovery and perspectives in contrast with our presumptions. Through interrogating the discrepancies, we strived to depict an objective picture of the phenomenon under investigation.

4 Findings

We organize the findings according to the research questions. We first report student voice in feedback, followed by teacher response to it and both parties' perceived effectiveness of the redesigned practice.

4.1 Student voice in feedback

Student voice is presented in four aspects: (i) Task goals; (ii) self-reflections; (iii) understanding of teacher feedback; and (iv) plan to do in the next practice. [Table 2](#) exemplifies their voice in each aspect. Pertinent FGD findings are reported to cast light on students' experiences.

All the 48 student participants completed the section on task goals. Their goals mainly pertained to the structure and skills required of their practice task. When asked about why they focused on task structure and skills application in the FGDs, they mentioned that their performance in the GCE O-Level exam would be graded according to these categories, and they learnt about these requirements from the pre-task discussion. From the discussion of the checklist and exemplar worksheet, they realized that a well-written task response should contain a clear stance substantiated by evidence from source readings. The thinking wheel reminded them of the higher-order thinking skills expected of the task. Two points could be inferred from the data. First, positive washback was evident when the scaffolding increased their understanding of task and exam requirements. Second, their deep understanding enabled the setting of mastery goals (goals motivated by one's intent to self-improve or grow; [Dweck, 1988](#)). In line with [Shen et al. \(2024\)](#), their goal-setting behavior was highly associated with their exam preparation efforts in the high-stakes assessment environment.

Concerning self-reflections, all students expressed their post-task feelings and thoughts on the feedback logs. We observed a range of student voice. Some learners expressed pride in task performance and shared their achievements with teachers. We interpreted this as the evidence for students' psychological need for competence. Other learners reviewed time management skills, revealed inadequacies, and expressed uncertainty. The data seemed

to imply that they felt psychologically safe to discuss their learning problems and to seek academic assistance.

Twenty-four students articulated understanding of teacher feedback. Their voice fell into two categories: (i) recognizing problems; and (ii) seeking clarification of teacher feedback. A closer look of their voice showed that they mainly agreed with teacher's judgment but did not generate internal feedback. This aligned with [van der Kleij's \(2020\)](#) observation about students' interpretation of feedback. There was one exceptional case where a student shared how she viewed her time management issue after reading the teacher comment. This case is further unpacked in Vignette B in Section 4.2. For those who chose not to respond to teacher feedback, we uncovered two reasons from the FGDs. First, they preferred a verbal discussion as it was hard to communicate their thoughts in writing. Second, a student (Harry) did not see the need for making response as he believed sharing his thoughts about the feedback would not raise his grades.

In consistent with [van der Kleij's \(2020\)](#) study, only a few students (12 in our study) outlined a concrete plan to do in the next practice. From the FGDs, we found three reasons why the majority of the students left this section blank. First, some failed to come up with suggestions to improve their work. Second, some valued teachers' suggestions more due to the expert role in subject knowledge. This was exemplified by Dave's quote "rather than trialing different methods on my own, following teachers' suggestions would be the straightforward way to improve performance." Third, some doubted the transferability of improvement strategies from the current to the next task because task content and skill set varied according to topics. This point is further elaborated in Section 4.3.3.

4.2 Teacher response to student voice

To examine how teacher response would shape students' feedback engagement, we identify three feedback vignettes to depict the reciprocal interaction. These vignettes are selected because they feature different kinds of student involvement in feedback processes.

4.2.1 Vignette A

Lucy was a learner with high self-efficacy and a solid understanding of success criteria. She always performed well in Social Studies. Before undertaking the task, she set the goal "Write a well-elaborated paragraph with cross-reference." After task engagement, she felt satisfied with her performance and wrote "I think this is the best practice I've done so far." for self-reflections. When assessing her work, Philip (Lucy's teacher) thought she did a good job. He praised her with the comment "Well done! You did it! I'm really glad to see you achieve this on your own! Grow in confidence. You can do it." He put a tick in the outer ring of the mini thinking wheel to indicate her strengths in comparing sources and developing provenance. Lucy did not write anything for understanding of feedback and plan for the next task. Philip did not put down any suggestions either as her work was of excellent quality. The interaction ended at this point.

Vignette A was a straightforward case of how a teacher responded to a student's psychological need for competence. Taking pride in task performance, Lucy shared her joy in the self-reflections with the intention of getting Philip's recognition. His positive feedback and encouragement confirmed her achievement. The dialogue was not further developed as Lucy's need was fulfilled and there was little room for further improvement. Neither Lucy nor Philip initiated another round of feedback conversation.

4.2.2 Vignette B

Lavender cared about her performance in the practice task because she believed the task helped her prepare for the GCE O-Level exam. As an average ability learner, she would like to advance her performance. She set her goal as "Write 2 comparison paragraphs and make reference to other sources," which was one level higher than her current one. During self-reflections, she recognized her weakness in time management and wrote "I spent too much time reading both sources to get the main ideas. This wasted lots of time. I should have limited reading time to 5 min in exam." To soothe her, Amy (Lavender's teacher) replied "No need to pressure yourself this way. Perhaps you could use the question to frame your thoughts and references." Reflecting on the given suggestion, Lavender realized her issue and came up with a plan to reduce reading time. Amy thought Lavender's plan was viable and encouraged her to apply the strategy in the next practice.

Vignette B demonstrated how a teacher provided a student with relational and competence support. Lavender was not satisfied with her time management skills and worried that this problem would affect her exam performance. In response to her self-reflections, Amy consoled her and suggested a strategy to improve time management. With Amy's care and concrete suggestion, Lavender felt more confident to tackle her problem and could devise an improvement plan. In the FGD, Lavender said she felt respected and supported when her voice was heard by her teacher. This engendered her confidence in acting on teacher feedback. This scenario showed the importance of teacher's emotional support to students' uptake of feedback (cf. [Steen-Utheim and Wittek, 2017](#)).

4.2.3 Vignette C

Elizabeth lacked confidence in higher-order thinking skills and needed support in making inference. On the feedback log, she put down "Write a paragraph that shows inference" for task goal. For self-reflections, she explained how she had made inference in the practice task and expressed her uncertainty about quality of performance, hoping to get confirmation from her teacher. When grading her work, Johnson (Elizabeth's teacher) ticked the sentences in relation to inference but did not write any comments to address her concern. He instead threw the questions "What is the author context?" and "How does the context influence the author's stance?" to stimulate her thinking about making cross-reference. After receiving the feedback, she did not respond to it and did not make the plan for the next task. For suggestions, Johnson wrote comments to advise her to consider the outer ring of the thinking wheel and the relationship between the key points of the source material and the author's context. There was no further conversation between both parties.

Vignette C exemplified a case where a student believed her voice was not heard. Elizabeth would like to know how well she could make inference, so she described how she achieved the goal in the self-reflections and expected teacher feedback on her goal accomplishment. However, she felt her need for competence unfulfilled as Johnson did not directly comment on her inferencing skills and raised questions to stimulate her thinking about cross-referencing instead. In the FGD, she expressed disappointment about the teacher response, so she did not write anything in return. In fact, Johnson addressed Elizabeth's need through ticks, but this was not the way she had expected. If he had confirmed her mastery of inferencing skills first, this would have instilled her confidence and encouraged her further participation.

4.3 Perceived effectiveness of the redesigned feedback practice

To explore the perceived effectiveness of the redesigned practice, we compare students' and teachers' perspectives on three main aspects of feedback communication (setting ground for reciprocal exchange; ways to communicate feedback; making feedforward).

4.3.1 Setting ground for reciprocal exchange

Both students and teachers believed that stating task goals and self-reflections effectively primed them for the feedback dialogue. The following quotes convey students' views.

At first, I was clueless why I had to do reflections. The teacher said we would not receive any feedback unless we told her how we thought of our work. Later, I figured out that we played a role if we wished to get useful feedback. (Dave, student FGD 3)

This arrangement helped teacher understand me better. When I answered the question wrongly, he could understand what I wanted to do and what hindered me from doing so. He could base the feedback on it. I feel like I have some say of the feedback content, so I expect his reply to my self-reflections. (Pete, student FGD 1)

Making one's goals and self-reflections explicit strengthened students' role in feedback and encouraged their participation. Through unpacking cognitive process to teachers, they realized that disclosure of self-assessment enabled teachers to understand their learning needs and customize feedback accordingly. This gave them a sense of autonomy and motivated them to engage with teacher feedback in the subsequent stage.

Echoing the students' opinions, the teachers expressed the following.

Different from our previous practice, we could now understand their thoughts and emotions. This is a good opportunity to develop communication and rapport with individual students. (Philip, teacher interview 2)

This practice helped us narrow feedback focus and provide personalized support. For students weak in paragraph structure, we highlighted the missing part and referred them to the

exemplar. For those who already met the baseline, we used the thinking wheel to further develop their thinking. (Johnson, teacher interview 2)

Their self-reflections tell us their level of confidence when attempting the question. This is very important to me. If I know they are not so ready, I would walk them through the challenges. (Amy, teacher interview 2)

The teachers opined that an understanding of learners' goals and self-reflections facilitated feedback provision. The redesigned practice increased their knowledge of individual students' cognition and affect during task engagement. This offered them valuable input to personalize feedback, differentiate learning support, and foster relatedness with students.

4.3.2 How to communicate feedback

In juxtaposing both parties' perspectives, we discovered that students and teachers held differing expectations about the best way to communicate feedback. One of the differences lay in the importance of making acknowledgment.

I did not write anything for the response as the feedback was not related to my goal 'Write a paragraph that shows inference'. Except for ticks and underlining, the teacher did not mention my inferencing skills. I want to know whether I performed well. (Elizabeth, student FGD 3)

If students could achieve their goal, I would put a tick. My comments prompt them to think about the parts requiring further efforts. Social Studies is a thinking subject. I would train them to see things from a different perspective. This skill could be applied in other tasks. (Johnson, teacher interview 2)

Both quotes point to the value of giving acknowledgment in feedback processes. Elizabeth, whose experience depicted in Vignette C, expected her teacher to begin the dialogue with written comments to acknowledge her competence. This may reflect the view of learners without a strong academic foundation because they need a confidence booster before delving into areas for improvement (Mulliner and Tucker, 2015; Pricinote et al., 2021). However, Johnson valued the development of thinking skills more as this was the discipline-specific feature of Social Studies. Though he ticked some sentences, Elizabeth interpreted this as not taking her voice seriously.

Another point of divergence involved the provision of marks. The quotes detail both parties' perspectives.

We do not state marks because some students would not read our feedback if they are okay with the marks. For a 7-mark question, some getting 5 may think they are good enough and do not bother about the missing points. However, the missing points are related to critical thinking. It would be more beneficial if they digest the feedback before getting the marks. (Amy, teacher interview 2)

I am not quite sure about my performance. I prefer teacher ticking the grids on a rubric and putting down marks and comments on my work. Marks tell me how far I am away from

the target. Comments tell me the problems and how to do better. I get feedback in practice exercises in History and English. (Patrick, student FGD 3)

Similar to Irwin et al. (2013), Amy withheld marks because she thought the concurrent release of marks and comments would discourage students from upgrading performance if they were complacent with the results. However, Patrick asserted the complementarity of both components in communicating performance gap. His view coincided with the students in the studies of Alhadabi and Karpinski (2019) and To et al. (2023a). Rather than seeing low marks in practice tasks as a demotivator, they regarded numeric feedback as an indicator of their learning progress.

4.3.3. Making feedforward

Since only a handful of students had outlined their plan for the next practice, we looked into their hurdles in this part of feedback processes. Two main themes emerged from the data: (i) lack of instant teacher support; and (ii) difficulties in setting a plan for future tasks. We delineate the first theme in the following.

I have a rough idea, but describing what I plan to do seems not very practical. I think talking about my plan and hearing what the teacher says would be more useful. (Judy, student FGD 2)

Verbal discussion may help. I would approach teachers to figure out the direction through asking questions and analyzing their answers. This works for me, but I know others seldom talk to teachers outside class. (Annabelle, student FGD 1)

Both students highlighted the importance of developing an improvement plan via verbal exchange with teachers. Particularly, the instantaneous response from teachers was crucial in promoting deep thinking (Alexander, 2020) and advancing their zone of proximal development (Vygotsky, 1978). Nevertheless, as mentioned by Annabelle and the subject team in Section 3.5, most students were not proactive in discussing improvement plans with teachers outside class. This raised two concerns: (i) the appropriate form of dialogue to aid students in making feedforward; (ii) the need for reserving curriculum time to engage students in verbal discussion of improvement plans.

The second theme related to the cognitive demands in setting a task plan. A student and a teacher explicated the challenges as follows.

To set the plan, I need to know the task, think whether I attempted similar type of question before, recall my previous task experience and consider if the feedback helps. If I do not know what the next practice is, it is hard to do so. (Pinky, student FGD 3)

For Social Studies, even if two questions assess the same set of skills, the response should be contextualized to the topic and source. So, what is learnt from this task may not be fully applicable to the next. This is different from Math. When you see a certain kind of question, you can apply the formula to solve it. (Johnson, teacher interview 2)

The above quotes pointed to two difficulties in making feedforward in Social Studies. First, since the content and skills requirements in case study questions varied according to topics, students needed to discern the contextual differences between questions, to recall their prior task experiences, and to think how they could apply previous feedback for task planning. The cognitive skills involved were akin to the three steps in the transfer process (recognize, recall, apply; Barnett and Ceci, 2002). However, the redesigned feedback practice did not equip students for the transfer. This issue was brought up for discussion in the teacher interview 2. To support students' transfer of feedback insights, the subject team planned to explicate such cognitive processes during in-class explanation of problems and suggestions, and to design a series of practice tasks allowing students' refinement of thinking skills. Second, the disciplinary nature of Social Studies posed another challenge for making feedforward. Due to the uniqueness of case study questions, it seemed essential for students to develop not only the skills but also a critical understanding of topics and source materials in transferring skills from one task to another. However, such training had not been offered to students.

5 Discussion

5.1 Student voice in feedback processes

This study explores student voice in feedback processes in the exam-oriented context with the aim of informing productive feedback designs. What distinguishes ours from other learner-centered feedback research (e.g., Fletcher, 2018; To et al., 2023a; van der Kleij, 2020) is the dissection of student voice and teacher response to it and the examination of student voice from the self-determination perspective. From the findings, we ascertain student voice in three main aspects: (i) grades (numeric feedback) as an indicator to monitor goal achievement and exam preparation efforts; (ii) challenges in making feedforward; and (iii) learners' feedback engagement and motivation largely shaped by teacher response.

Our findings lend a fresh perspective to the concurrent release of grades and comments. Previous assessment literature (e.g., Hattie and Timperley, 2007; Lipnevich and Smith, 2009) warns us about the negative impact of grades on students' feedback engagement. This led the Social Studies teachers in our study to withhold marks in order to enhance students' engagement with feedback (cf. Irwin et al., 2013). However, our student participants did not quite appreciate this approach. Consistent with those in Alhadabi and Karpinski (2019) and To et al. (2023a), they believed that marks complemented comments in aiding exam preparation: the former indicated the discrepancy between their current and desired performance levels; the latter gave them specific suggestions to reach the desired goal. Unpacking this case from the self-determination lens, we speculate that this group of upper secondary school students may have internalized extrinsic motivation, have seen marks (external motive) as a regulation tool, and have enacted identified regulation. Inferred from the data, enabling students to set mastery goals and fostering their achievement orientation seem to support their internalization of extrinsic motivation.

Similar to van der Kleij's (2020) discovery, few students in our study devised a plan to make feedforward. While van der Kleij (2020) ascribes this issue to lack of reflective skills training, our analysis of student voice revealed other possible causes. On epistemic grounds, some students such as Judy may be reluctant to produce an improvement plan due to the perception that suggestions from the knowledge expert (teachers) would be more effective for exam preparation (Tan and Wong, 2018). On cognitive grounds, the feedback design in the study may overlook students' obstacles in making feedforward. Explained by Pinky in Section 4.3.3, translating teacher feedback into improvement acts required her recognition, recall and application of previous task, and feedback experiences to make far transfer (Barnett and Ceci, 2002). These higher-order thinking skills appear to be the discipline-specific feature of Social Studies, given the context-dependent nature of tasks in this subject.

The feedback vignettes in Section 4.2 provide corroborating evidence for Plank et al.'s (2014) proposition that teacher response to student voice could influence students' feedback engagement and motivation. Depicted in Vignette B, the teacher's consolation and suggestion fulfills Lavender's psychological needs for relatedness and competence, respectively. This allows her to appreciate the value of feedback dialogue and thus increases her volition to engage with feedback. In contrast, the unfulfillment of Elizabeth's competence need in Vignette C weakens her interest in feedback participation, leading to amotivation. Her case also demonstrates the significance of confidence building when interacting with less capable learners. Echoing the viewpoint of Mulliner and Tucker (2015) and Pricinote et al. (2021), low self-efficacious learners would feel psychologically safe to participate in feedback processes if they could gain confidence at the outset of dialogue.

5.2 Implications for feedback designs

Drawing on this study and pertinent literature, we derive insights into orchestrating productive feedback designs. Given the importance of understanding student voice (Plank et al., 2014), teachers could develop feedback tools, for example the feedback log or the project planning guide (Fletcher, 2018), to ascertain students' goals, task-related emotions, self-reflections and interpretation of comments. Doing so not only grants students' autonomy to articulate their psychological needs for competence and relatedness (Ryan and Deci, 2017, 2020) but also helps teachers recognize individual learners' needs and customize learning support. It is noteworthy that students accustomed to the teacher-centered approach may fail to identify their own feedback needs (Boud and Molloy, 2013). Hence, it is advisable for teachers to enhance students' knowledge of success criteria and self-reflection skills through discussion of rubrics, exemplars and checklists (Fletcher, 2018) or peer assessment (To et al., 2023b). Some students may not see the value of self-disclosure or may be hesitant to reveal feelings and thoughts. This could be tackled by an explanation of the benefits of self-disclosure and the establishment of a psychologically safe atmosphere to encourage students' articulation of voice (Steen-Utheim and Wittek, 2017; Johnson et al., 2020).

In addition to ascertaining student voice, teacher response to the voice plays a pivotal role in determining the effectiveness

of feedback designs (Lundy, 2007; Plank et al., 2014). Since their voice varies according to individuals' proficiency level, self-efficacy, teacher-learner relationship and other factors (Winstone et al., 2017), it is imperative for teachers to have a thorough understanding of individual learners and be flexible in making response. While a written reply to recognize achievements may suffice for capable learners (Vignette A), low self-efficacious learners may benefit more from verbal exchange to build confidence in judgment making before discussing performance gaps and brainstorming suggestions (Vignette C). To support this type of learners, teachers could consider adopting Fletcher's (2018) practice, engaging students with similar needs in feedback consultation meetings during lessons.

A controversy over feedback practices in exam-oriented settings centers on the timing of grade release—whether students should receive grades and comments simultaneously. Our position is that educators should take account of students' emotional maturity, learning orientations and academic experiences in decision making. If students are achievement-oriented and resilient to negative emotions, they could regard unsatisfactory results as an opportunity to readjust learning efforts (also known as attention deployment strategy, see Harley et al.'s (2019) emotion regulation model for details). Given the circumstances, the concurrent release of grades and comments may not hamper their engagement with feedback but contribute to self-regulated learning. However, for younger kids who are unable to cope with negative affect, educators had better provide them with comments and guide them to reflect on the given information prior to grade release (cf. Irwin et al., 2013). Along with the adaptive release of grades, educators are highly encouraged to strengthen students' emotion regulation through discussing the meaningful use of grades and comments for academic regulation, developing their resilience to negative feedback (To, 2016), and nurturing their growth mindset through classroom interaction (Ramani et al., 2019).

Supporting students to make feedforward is significant for feedback designs. From this study, we learn that simply understanding students' difficulties in feedback uptake is far from adequate to support feedforward. What seems useful would be the employment of discipline-specific strategies to enable students' transfer of cognitive skills and feedback insights. While language teachers may adopt the draft-plus-rework design to create opportunity for feedforward (e.g., Fletcher, 2018; To et al., 2023b), this may not suit Social Studies teachers due to the context-dependent nature of case study questions and the emphasis of higher-order thinking skills. Informed by the findings in Section 4.3.3, it would be more beneficial to engage students in reciprocal verbal exchange where dialogic feedback could stimulate their thinking, aid their analysis of task context, and expand their zone of proximal development (Alexander, 2020; Vygotsky, 1978). This may imply the need to revisit the existing subject curriculum to find lesson time for meaningful feedback dialogue.

5.3 Limitations and future research

This study has three limitations. First, our discovery of student voice is far from comprehensive since the sample is confined to a small group of upper secondary school learners in a Singapore

school. Those in junior secondary with less exam pressure may have different expectations and perspectives on feedback. Future research could compare student voice in various academic contexts and identify the factors influencing their opinions. Second, the feedback redesign for Social Studies may not be suitable for languages, mathematics and other subjects as feedback practices are shaped by the discipline-specific features in pedagogy and assessment (Carless et al., 2023; Quinlan and Pitt, 2021). It would be fruitful for researchers to explore the feedback characteristics of various subjects so that insights into discipline-specific feedback designs could be gleaned. Third, due to the school's exam preparation work in Term 4, we could not conduct a follow-up investigation to see if the inclusion of verbal dialogue would improve students' understanding and uptake of feedback. This issue could have been circumvented if we had factored in the school's exam preparation period when planning for data collection. It would be beneficial for researchers to have forward planning with participating schools to ensure data collection work for two consecutive terms.

6 Conclusion

Engaging students in feedback is challenging when learners' needs and voice are unknown to teachers. To tackle this issue, this paper has discussed how teachers could identify and address student voice in feedback processes. In collaboration with the Social Studies subject team, we developed a feedback log for students to express their competence and relational needs during feedback processes. From the findings, we have learnt that this feedback tool grants students autonomy to articulate task goals, emotions, and self-reflections. However, the centrality of dialogic feedback lies in teachers' fulfillment of learners' needs through verbal reciprocal exchange to develop their confidence in judgment making and higher-order thinking skills for feedforward.

Provided that one size does not fit all, we do not intend to present our feedback design as the solution to the feedback conundrum. By delineating the subject team's considerations and student voice in feedback processes, we wish to provide researchers and practitioners with insights so that they could design their own feedback practice to identify and meet their students' needs.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Nanyang Technological University, Institutional Review Board. The studies were conducted in accordance with the local legislation

and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin. Written informed consent was obtained from the individual(s), and minor(s) legal guardian/next of kin, for the publication of any potentially identifiable images or data included in this article.

Author contributions

JT: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. DA: Data curation, Project administration, Writing – original draft, Writing – review & editing. KT: Conceptualization, Funding acquisition, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Gen AI was used in the creation of this manuscript.

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Appendix

Appendix A. Focus group discussion questions

1. How do you see the main purposes of feedback?
2. Could you briefly describe the feedback practice you experienced in this school term? To what extent is it different from the previous feedback practice?
3. We would like to know more about your sharing on the feedback log. For the highlighted parts, could you tell us your thoughts when you were completing your feedback log?
4. How do you find the usefulness of this feedback practice? Which part was most useful? And which part was less useful?
5. Did you encounter any difficulties in understanding the teacher feedback? If yes, what were the difficulties? What kinds of support did you need?
6. Did you encounter any difficulties in planning for the next task? If yes, what were the difficulties? What kinds of support did you need?
7. How did you use the teacher feedback to improve your performance? Can you give me an example for illustration?
8. Is there anything you might want to say about this feedback practice that we have not discussed so far?

Appendix B. Semi-structured teacher interview questions.

Interview 1

1. Could you tell us your teaching background, for example your teaching experience and your role in the subject team?
2. How do you see the purposes of feedback and the role of teachers and students in feedback communication?
3. How does the existing feedback practice look like?
4. How do you see the effectiveness of this practice? What are the major problems with this practice?
5. In what ways would your team like to redesign the feedback practice? What kinds of support do you require from our team?

Interview 2

1. Could you tell us how your team implemented the redesigned feedback practice?
2. How do you see the effectiveness of the redesigned feedback practice? What were its strengths and weaknesses?
3. Did you encounter any problems in responding to student voice? If yes, what were the problems? How did you overcome them?
4. From the focus group discussions, some students said they would like to receive marks and feedback at the same time. May I know your views on this point?
5. From the focus group discussion, some mentioned it was hard for them to come up with a plan for the next task. May I know your views on this point?
6. If you had a chance to re-implement this practice, would you make any changes to improve it? If yes, why?

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